

Does cutaneous sebum affect the skin uptake of chemicals?

The human skin is covered by a mixture of lipids called sebum. Some components of human sebum are involved in the formation of the epidermal skin barrier inhibiting the uptake of exogenous substances. For experimental dermal penetration studies, often excised human skin from plastic surgeries is used. However, whether the skin sebum film is affected by disinfection and whether this might influence the skin uptake of chemicals was unclear.

This study investigated the effect of an artificial sebum similar to native human sebum on the skin penetration behavior of two prominent chemicals, ethanol and toluene. In addition, the comparison with the effects of a regular skin cream was included in the study, as topical skin cream application might enhance the dermal absorption of chemicals.

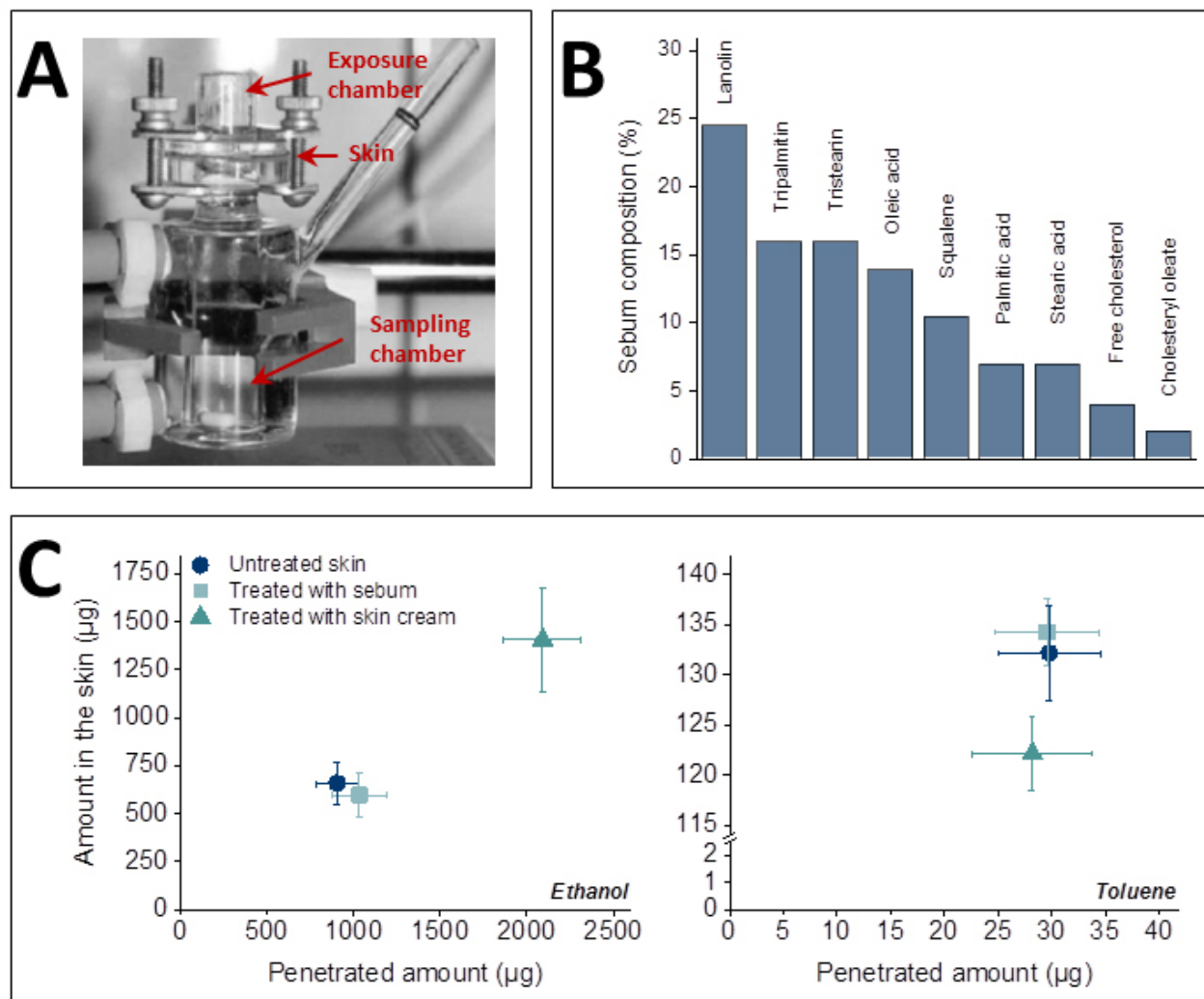


Fig. 1. A Franz diffusion cell; B Composition of artificial sebum expressed as a percentage; C Relationship between through the skin penetrated amounts and the amounts remained in the skin

of ethanol and toluene in dependence of skin treatment.

Excised human skin from abdominal area was used for experiments under physiologically similar conditions. Ethanol and toluene were applied on the upper side of untreated as well as on with a skin cream (oil-in-water- and water-in-oil-emulsion) or with sebum treated skin fixed between the two chambers of the Franz diffusion cell (Fig. 1A). For the duration of experiments (4 h), the exposure chamber was occluded to avoid the evaporation of the chemicals. Artificial sebum was prepared similar to the natural human sebum (Fig. 1B). The skin penetration was assessed from the concentrations of ethanol and toluene in the sampling chamber of diffusion cells filled with physiological saline solution as well as in skin punches which were taken at the end of experiments. For chemical analysis carried out by gas chromatography, the skin punches were digested in aqueous potassium hydroxide solution.

Ethanol penetrated through the skin in a ~30-fold higher amount than toluene (Fig. 1C). For application of skin cream, a ~2-fold penetration enhancement of ethanol was observed. The treatment with sebum indicated no differences in penetrated amounts for both chemicals. Independent of skin treatment, the amount in the skin at the end of experiments compared to the amount in the sampling chamber was higher for toluene (4.3–4.5 fold) and lower for ethanol (1.4–1.7 fold). While sebum had no influence on the amount of test compounds remained in the skin, the intradermal fraction of ethanol was enhanced 2-fold by skin cream application.

This study indicates that sebum does not influence the penetration of two chemicals with hydrophilic (ethanol) and lipophilic properties (toluene) in and through skin. The adverse effect of penetration enhancement by application of skin cream as demonstrated for ethanol might be avoided if skin protection creams would be manufactured similar to human sebum.

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Publication

[Influence of artificial sebum on the dermal absorption of chemicals in excised human skin: A proof-of-concept study.](#)

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