

Improved structure of lipid lamellae and restoration of disrupted epidermal barrier in the elderly after four week treatment with a water-in-oil emulsion with pH 4

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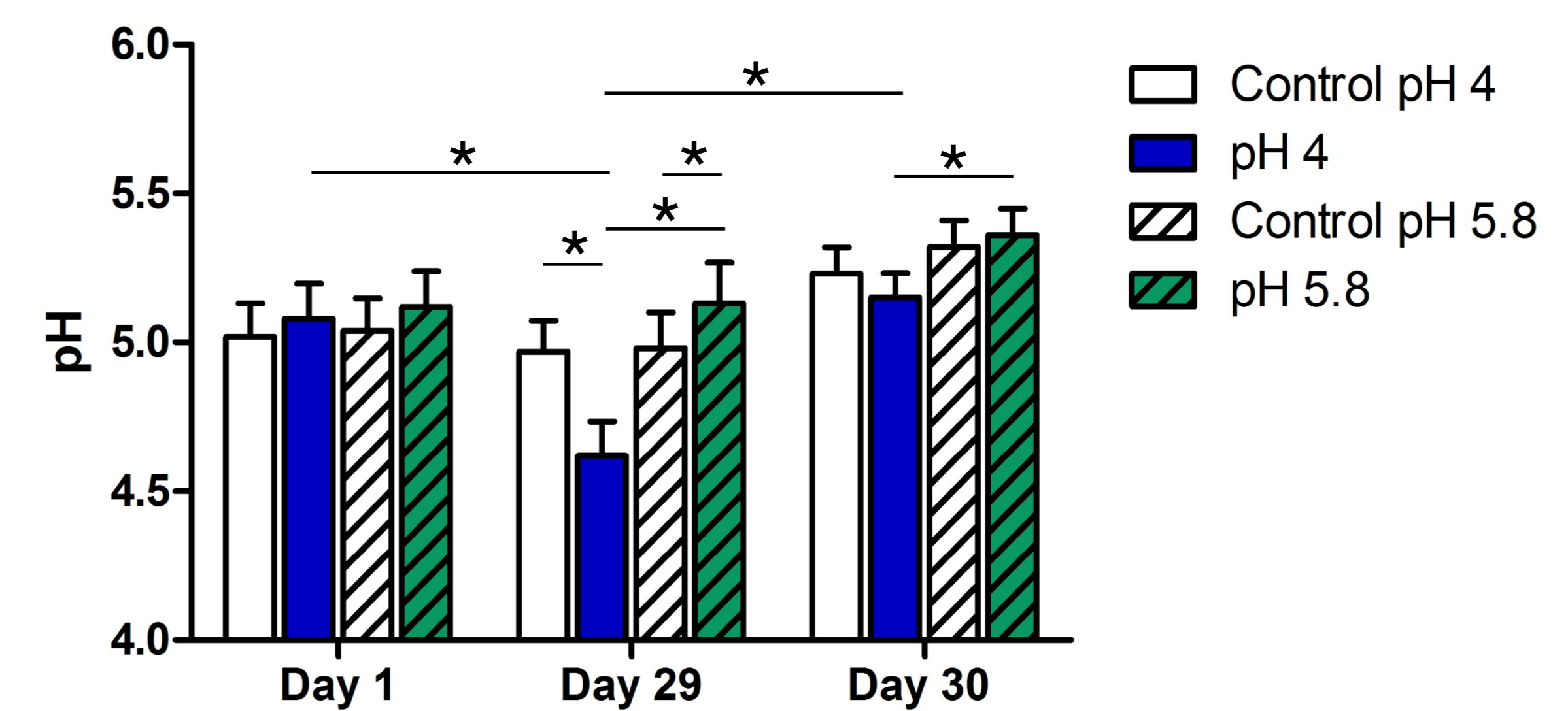
Introduction and methods

The pH of the skin increases with age. An increased pH is associated with a reduced epidermal barrier function. To improve epidermal barrier function aged skin needs appropriate skin care to counterbalance the age-related pH increase.

This a confirmatory, randomized study (with open label for negative controls and double blinding for test products) investigated the long-term efficacy of water-in-oil (w/o) emulsions with either pH 4 or pH 5.8 on the volar forearms of 20 elderly subjects after 4 weeks of treatment. Additionally, after completion of the treatment, the skin was challenged with an SDS solution in order to analyze the barrier protection properties of both formulations.

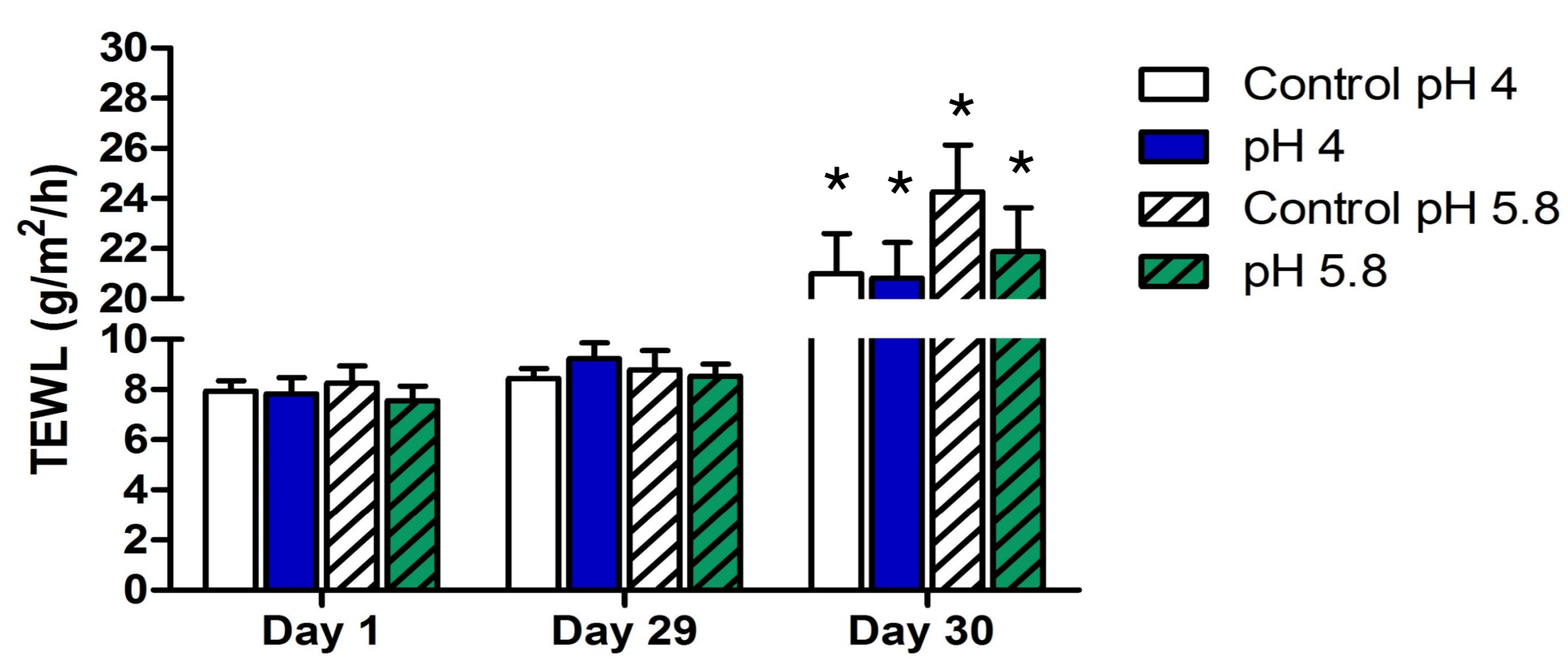
Skin pH, skin hydration and transepidermal water loss were evaluated at baseline, after treatment and after SDS challenge. In addition, the stratum corneum lipid lamellae structure was analyzed and the lipid content was determined.

Skin pH



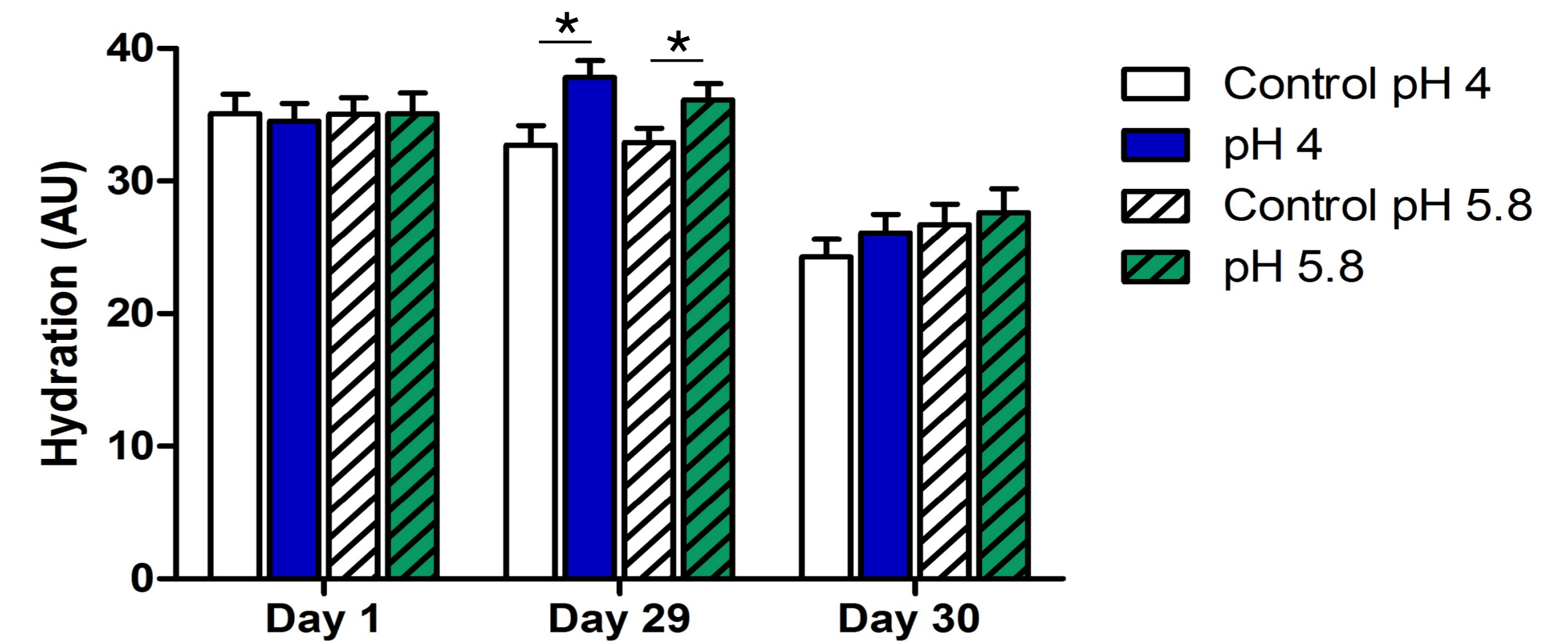
Skin pH was measured by SKIN PH METER PH 900 PC, (Courage & Khazaka, Cologne, Germany) at the day1, day 29 and day 30 of the study. The pH 4 emulsion significantly decreased pH, while the pH 5.8 emulsion increased it. Data are presented as means \pm SEM, * $p < 0.05$, N=19 volunteers/group.

Transepidermal water loss



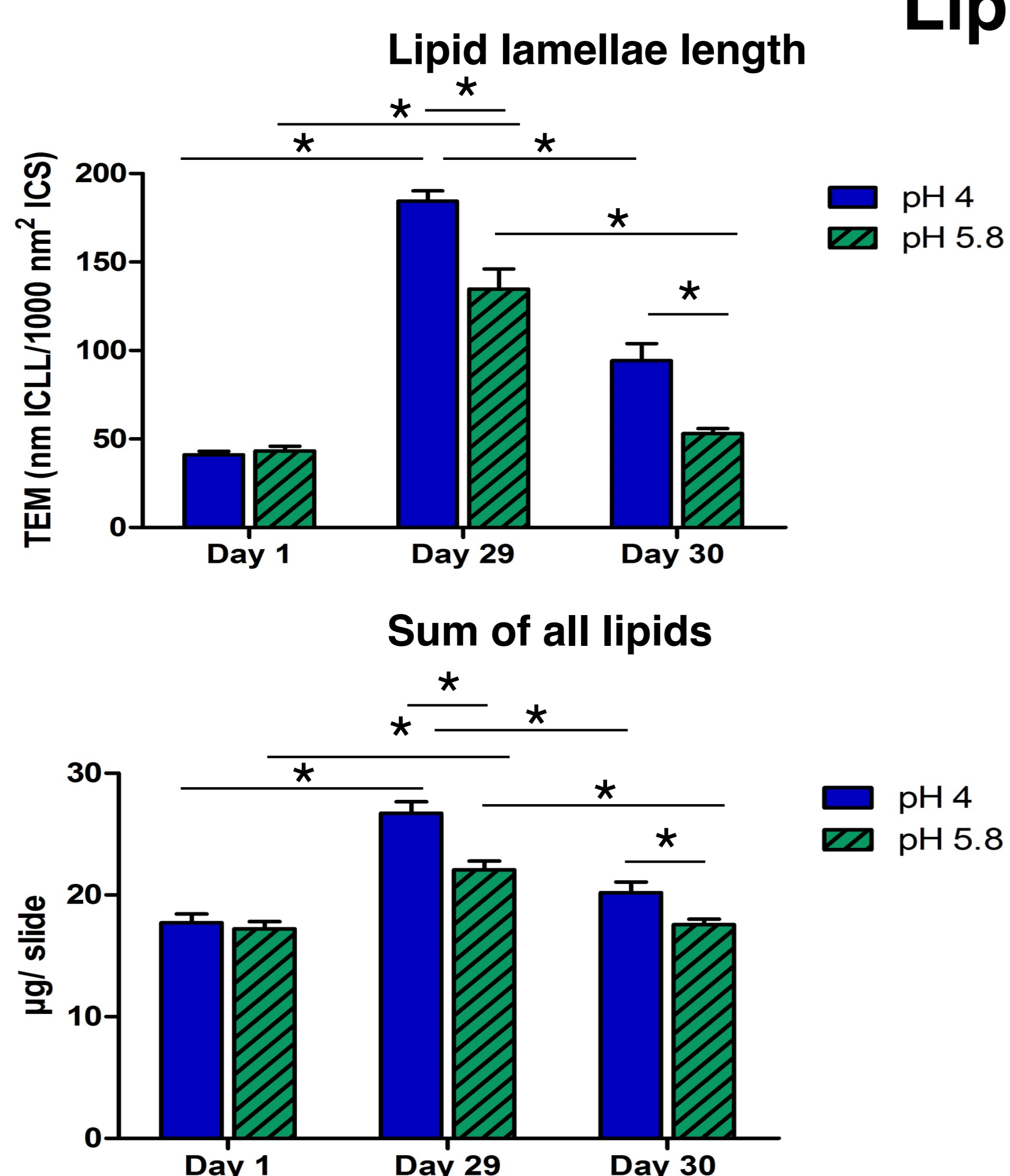
Epidermal barrier integrity, assessed by TEWL, did not show major change after 4 weeks of application of both emulsions. Treatment with SDS emulsion significantly increased TEWL at day 30 compared with day 1 and day 29. The results are presented as mean \pm SEM, * $p < 0.05$ vs day 1 and day 29, N=19 volunteers/group.

Corneometry

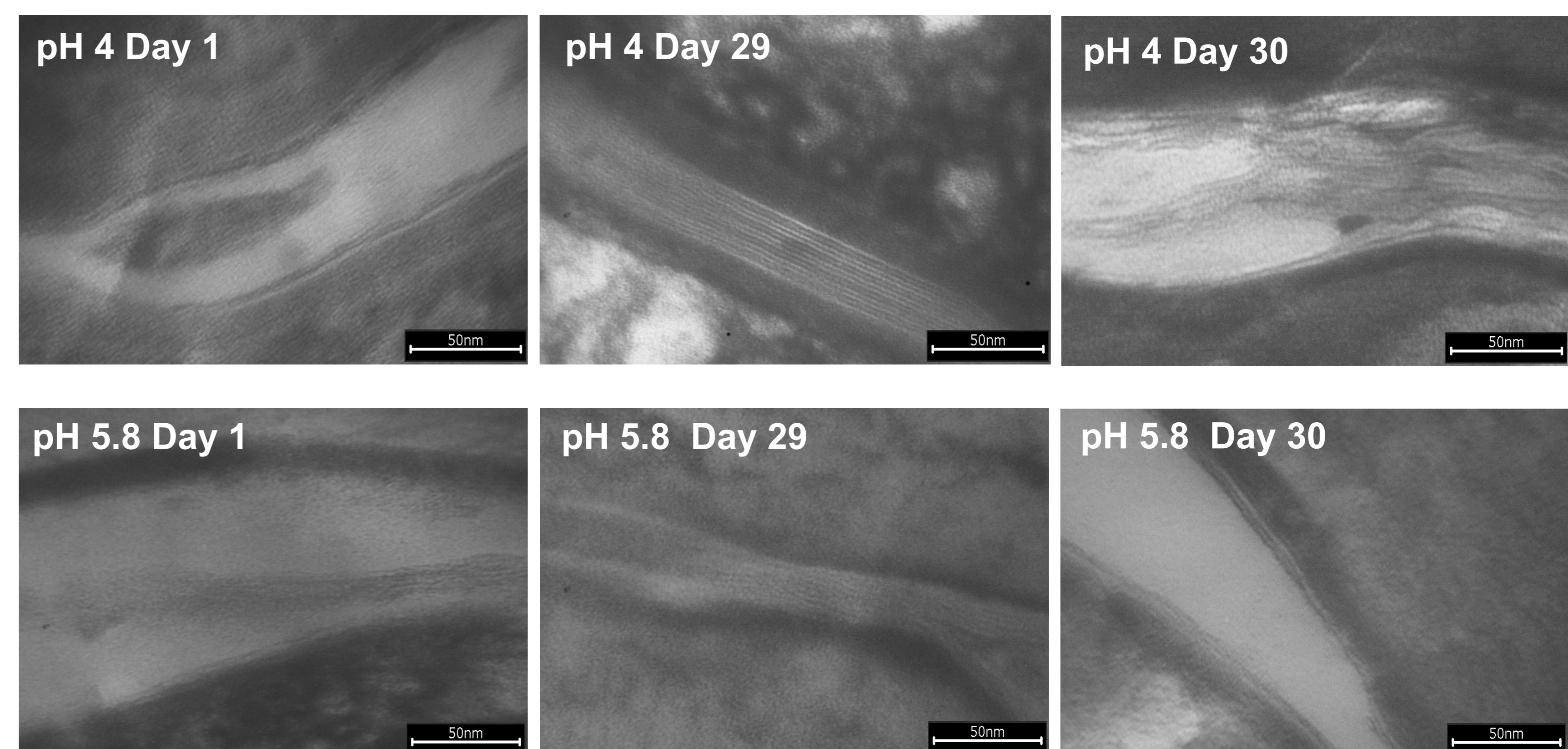


Skin hydration, assessed by the CORNEOMETER[®], significantly improved after 4-week (day 29) application of both emulsions. The results are presented as mean \pm SEM, * $p < 0.05$, N=19 volunteers/group.

Lipid lamellae length, ceramides and total lipids



TEM images of the lipid lamellae in the intercellular space



After light microscopically evaluation of the carrier including the stratum corneum sample an area with a homogeneous layer of corneocytes was chosen and prepared for subsequent transmission electron microscopy (TEM) analysis. The extraction of lipids from the corneocytes adhered on the carrier (slide) as well as their separation using the "High Performance Thin Layer Chromatography" (HPTLC) was performed according to Imokawa *et al.*. The length of the lipid lamellae in the intercellular space was significantly increased after application of both products. Moreover, sum of the total lipids were significantly increased after four weeks of treatment. Importantly, effects on lipid lamellae length, and total lipids were significantly higher for the pH 4 compared to the pH 5.8 emulsion. The results are presented as mean \pm SEM, * $p < 0.05$, N=14 volunteers/group.

Summary & Conclusions

This study provides evidence that topical application of a water-in-oil emulsion with pH 4 reacidifies the skin in elderly and has beneficial effects on skin moisturization, regeneration of lipid lamellae and lipid content. Hence, application of a pH 4 emulsion can improve the epidermal barrier as well as the SC organization in aged skin. Further investigations will reveal whether the application of an emulsion with pH 4 influences inflammatory and protease activities in the epidermis.