

Evaluation of a novel emollient plus providing protection against allergens and pollution, and relieving pruritus in atopic dermatitis

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INTRODUCTION

Atopic dermatitis (AD) affects millions of patients worldwide and significantly impairs quality of life. AD is characterized by skin barrier dysfunction, leading to the **release of keratinocyte- and mast cell-derived alarmins, including thymic stromal lymphopoietin (TSLP)**, which directly both activates sensory neurons involved in pruritus¹ and promotes type 2 inflammation².

Barrier disruption enhances the penetration of allergens, pathogens, and irritants and contributes to exaggerated immune responses. Moreover, AD patients frequently exhibit IgE reactivity to environmental allergens, microbes, or food proteins, which can trigger or worsen disease flares^{3,4}, sustaining a pathogenic cycle of chronic inflammation and skin discomfort.

MATERIALS & METHODS

Objective: To assess the ability of an ingredient to modulate TSLP production, and to assess an emollient+ (AD balm) for physical protection against triggering’s factors and its clinical efficacy in reducing pruritus.

- **In vitro evaluation of the inhibitor effect of an ingredient on TSLP secretion**

 - **Active ingredient tested:** glycyrrhetic acid
 - **Atopic-like in vitro model:**
 - IL-4/TNF-α/poly(I:C)-treated human primary keratinocytes
 - Active ingredient or dexamethasone 1μM (positive control) added to the culture medium on D0.
 - **TSLP secretion** quantified by ELISA in cell culture media on D1.

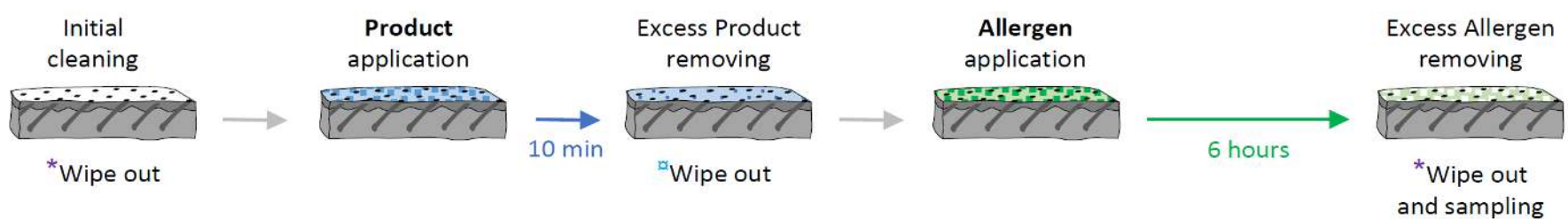
➤ **Ex vivo evaluation of an emollient+ on physical protection against allergens**

 - **AD balm:** an emollient+ containing a biomimetic lipid phase and the TSLP-inhibitor active ingredient (among other active ingredients)
 - **Ex vivo model:**
 - Human shaved scalp explants (model maximizing allergen accumulation by presence of hair follicle)
 - **Topical application of the AD balm** (10min later the excess of product was wiped out using a dry swab).
 - Allergens’ application: **topical application of each allergen** (coupled to Alexa Fluor 488) was done 10min after AD balm application, and **let in contact for 6 hours**. Before collection for analysis, the excess of allergen was wiped out. Allergens tested (2μL/cm²): house dust mite (Der p1, 0.40 mg/mL), cat (Fel d1 0.79 mg/mL), mold (Alt a1 0.18 mg/mL), peanut (Ara h2 0.26 mg/mL).
 - Allergens accumulation was assessed by image analysis of fluorescence surface on sliced explants (10 regions quantified per condition).
- **In vivo evaluation of an emollient+ on physical protection against pollution**

 - **In vivo evaluation:**
 - 10 healthy adults with light skin phototypes
 - **AD balm** or water (control condition) were applied on distinct areas on inner forearm, followed, 20min later, by deposition of carbon particles 1μm in diameter (modelling atmospheric pollution). Then, the areas were rinsed with water and cotton.
 - **Pollution accumulation** on skin was assessed by skin darkening measured by colorimetry (L* parameter).

➤ **Clinical evaluation of an emollient+ on pruritus reduction in atopic subjects**

 - **Open-label clinical study:**
 - 30 adults, 19-54 yo, with **chronic and relapsing atopic dermatitis** (on average: disease onset at 11 years old, with 6 relapses/year, without flare-up at the time of inclusion), **and significant itching** (Numerical Rating Scale [NRS] ≥4/10)
 - **In-lab pruritus relief assesement on Day 0, under dermatological control:** pruritus scoring on forearm by NRS before, 1min and 1h after AD balm standardized application, versus untreated area. Pruritus soothing was also assessed by satisfaction after 1 seconde.
 - **In-life pruritus soothing assesement:** Subjects applied twice daily the AD balm to face and body from Day 0 (after the lab test) and for 7 days. Pruritus soothing was self-assessed using a questionnaire.



RESULTS

➤ In vitro evaluation of the inhibitor effect of an ingredient on TSLP secretion

The active ingredient demonstrated a **strong efficacy in reducing TSLP secretion** by keratinocytes *in vitro*. Indeed, the tested active ingredient, glycyrrhetic acid, is known to inhibit $\text{KF-}\kappa\text{B}^5$, a transcription factor that induces TSLP gene expression in keratinocytes⁶.

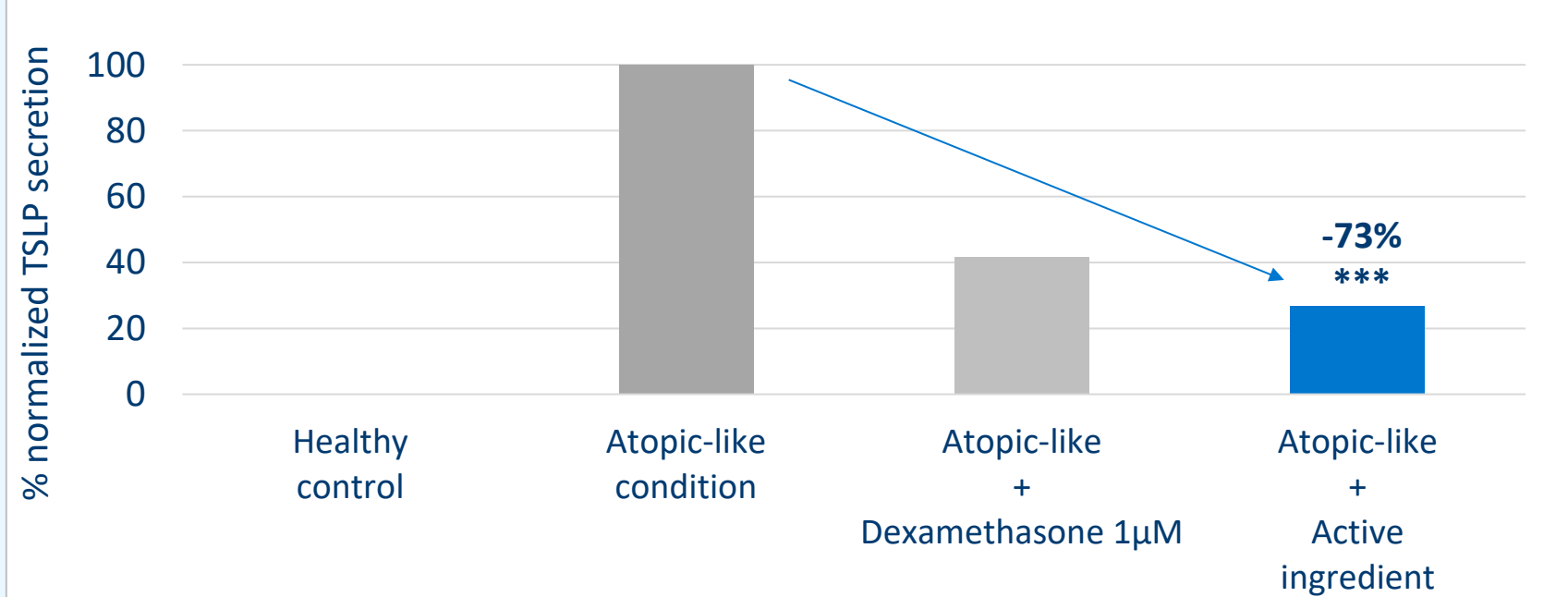


Figure 1. Inhibition of TSLP secretion by the active ingredient
Quantification of TSLP secretion by ELISA on IL-4/TNF-α/poly(I:C)-treated human keratinocytes. ***p<0.001, Student t-test, versus "atopic-like + vehicle" condition.

-73%
TSLP

➤ Ex vivo evaluation of an emollient+ on physical protection against allergens

On scalp explants, **the AD balm** (incorporating a lipid phase entirely made with skin biomimetic lipids) **significantly reduced the accumulation of allergens, thus demonstrating its ability to physically limit their skin penetration.**

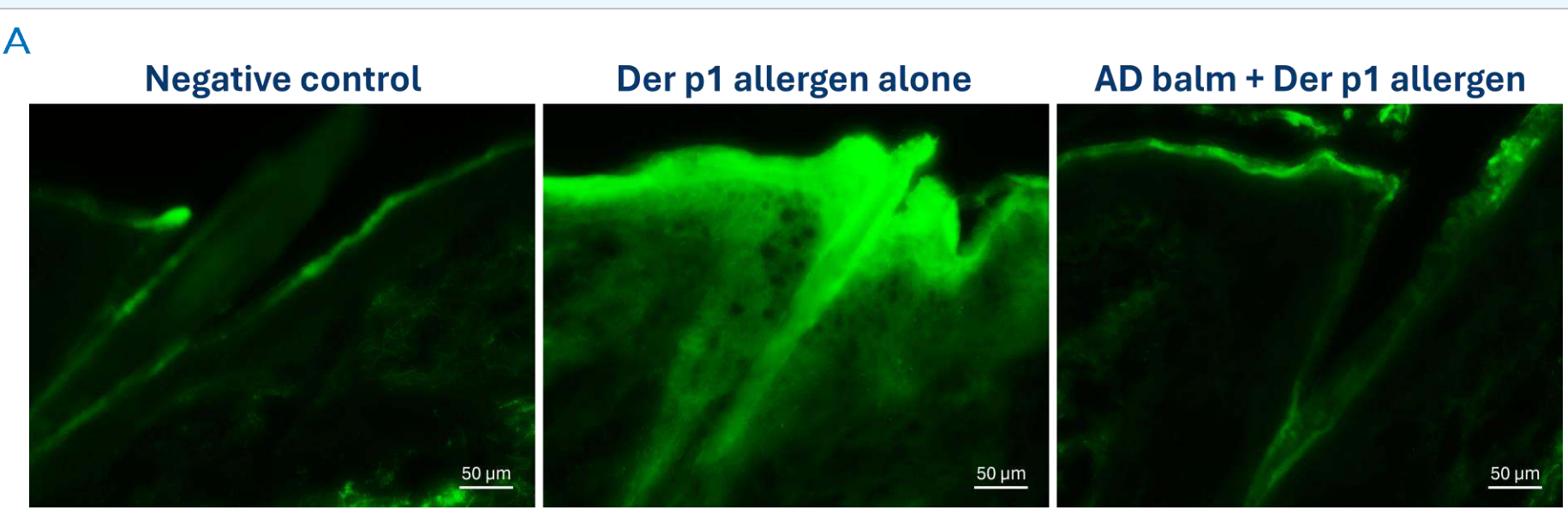
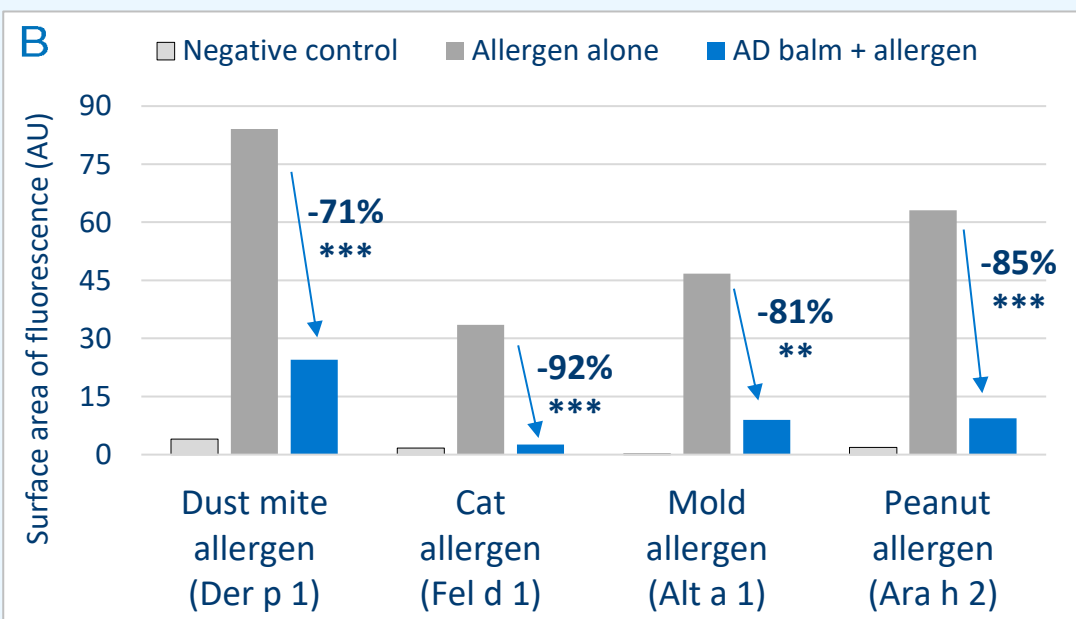


Figure 2. Allergens' accumulation reduction by the AD balm

A/ Representative immunostaining on human scalp explants (sections) of allergens on non-treated (left), allergen-treated (middle) and allergen-treated with previous topical application of the AD balm (right), with here the case of Der p1 allergen. B/ Quantification of allergens' accumulation by image analysis. **p<0.01, ***p<0.001, unpaired t-test, versus "allergen alone" condition

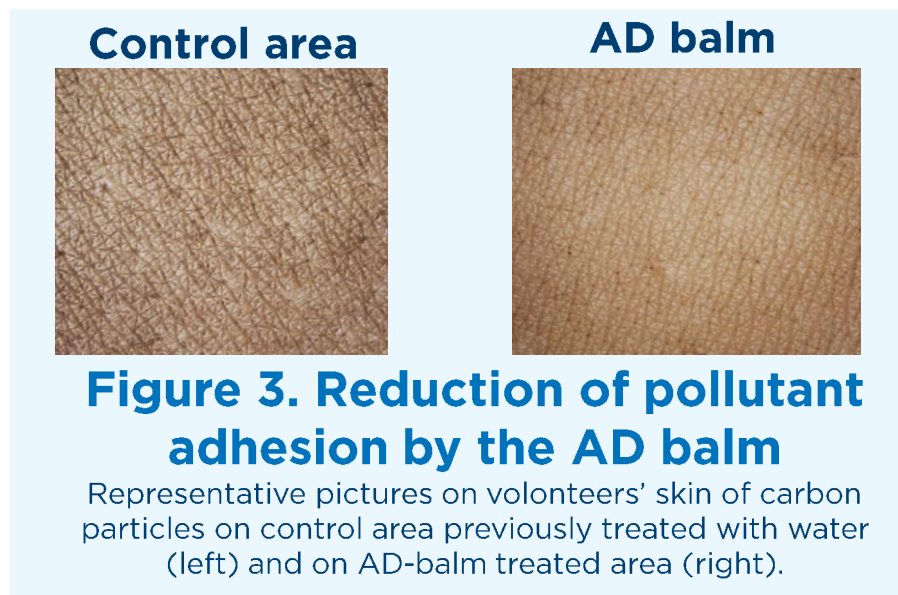


UP TO
-92%
ALLERGENS

➤ In vivo evaluation of an emollient+ on physical protection against pollution

Air pollution acts as a trigger that **exacerbates allergens sensitization** in atopic dermatitis⁷.

In healthy subjects, the AD balm demonstrated protection against the accumulation of pollution on the skin, with an **80% reduction** in residual carbon particles compared to the control area (p<0.001, Student t-test).



➤ Clinical evaluation of an emollient+ on pruritus reduction in atopic subjects

- On atopic subjects, the AD balm demonstrated pruritus **soothing within the first second**, as reported by 100% of subjects.
- Itch intensity was significantly **reduced by 55% after 1 minute and 82% after 1 hour**. This effect persisted throughout the day, with 96% of subjects still reporting pruritus relief after 10 hours.
- **After 7 days** of twice-daily use, more than **96% of subjects reported discomfort relief** (reduction in pain, tightness and irritation).

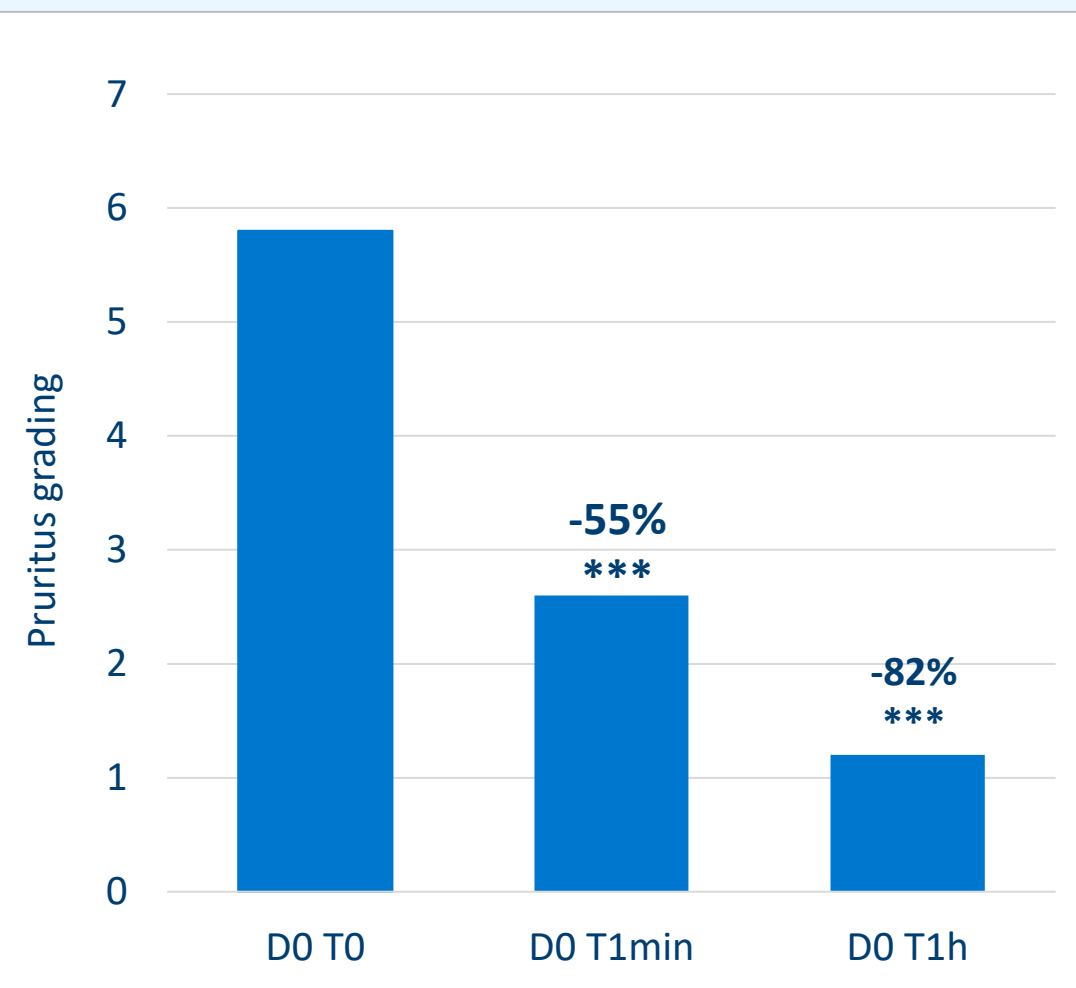


Figure 4. Pruritus reduction by the AD balm

Quantification of pruritus using a NRS before and after standardized application of the AD balm on forearm, normalized. Pruritus values were corrected by untreated area evolution over time. ***p<0.001, Wilcoxon signed-rank test versus D0 T0.

-55%
PRURITUS
AFTER 1MIN

-82%
PRURITUS
AFTER 1H

CONCLUSION/DISCUSSION

This **novel AD emollient balm provides rapid and long-lasting relief of pruritus** and skin discomfort in patients with atopic dermatitis. These clinical benefits may be partly explained by the **inhibition of keratinocyte-derived TSLP** by the active ingredient, and by the biomimetic lipid-replenishing phase. By forming a **physical barrier that limits allergen and pollution penetration**, the balm may contribute to **sustained skin protection and help reduce the risk of flare-ups**. Overall, this AD balm represents an effective supportive care to improve skin comfort and quality of life in patients with atopic dermatitis.

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⁶Hau CS, et al. Suppressive effects of antimicrobials on thymic stromal lymphopoietin production in human keratinocytes. J Dermatol Sci. 2013 Sep;71(3):174-83.

⁷Pan Z, et al. Impact of Air Pollution on Atopic Dermatitis: A Comprehensive Review. Clin Rev Allergy Immunol. 2023 Oct;65(2):121-135.