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Original Research

Plant-Biotech Moisturizer and Cold-Processed Soap Improve Atopic Dermatitis, Pruritus, and Biophysical Measures

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Relevance

Atopic dermatitis (AD) is a chronic inflammatory condition with a relapsing course. While topical steroids are commonly used in the management of AD, there is growing interest in the use of non-prescription or naturally derived products such as moisturizers and cleansers (e.g. unadulterated soap). Topical use of plant-biotech derived actives has shown anti-inflammatory and antioxidant effects, the potential to reduce pruritus, and the ability to restore the skin barrier.

Objective

This study evaluated the effects of an over-the-counter plant-biotech moisturizer combined with a gentle soap on the skin of individuals with mild to moderate AD.

Methods

An open-label trial was conducted involving 34 subjects over the age of 18 with mild to moderate AD. At baseline and day 56, SCORAD (SCORing Atopic Dermatitis), pruritus, mood changes, and skin biophysical measures were assessed.

Results

By day 56 the mean total SCORAD decreased by 99% ($p < 0.0001$), the objective SCORAD decreased by 94% ($p<0.0001$), and the pruritus numeric rating scale (NRS) improved by 93% ($p < 0.0001$) in comparison to baseline. All skin parameters improved as well.

Conclusions

A plant-biotech derived moisturizer and soap improved mild to moderate AD over the course of 8 weeks.

1. INTRODUCTION

Atopic dermatitis (AD) is a chronic inflammatory skin condition.[1] It is the most common form of dermatitis and is associated with significant impairments to quality of life.[2] AD lesions are described as ill-defined, pruritic, and erythematous. Lesions are commonly found in flexural regions but can affect any part of the body.[1,2]

Skin microbiome composition may be another important factor to address in understanding and managing AD. Those with AD have significantly higher relative abundance of *Staphylococcus aureus* in lesional and non-lesional skin regions relative to healthy controls.[3] Research suggests that decreased skin microbiome diversity, increases in *S. aureus,* and decreases in *S. epidermidis* are implicated in AD flares.[4]

Given increased awareness of the connection between the mind and the body, it is important to highlight the correlations between AD and psychological states. Studies suggest that adults with AD are more likely to report depressed mood and increased psychological distress.[5] Periods of psychological distress have also been associated with increased rates of barrier disruption.[6]

Maintenance therapy for those with AD consists of the regular use of emollients.[7] Standard first line treatment for flares consists of topical corticosteroid (TC) use with possible use of non-steroidal topical agents.[7] While these options can be effective for AD, there is growing patient concern about TC use, highlighting the need for alternatives,[1] like plant-biotech-based moisturizers.

Research suggests that plant-biotech-derived actives can support the skin barrier, modulate the microbiome, and decrease inflammation. For example, *Symphytum officinale* (comfrey), has anti-inflammatory properties and two key

components, allantoin and rosmarinic acid.[8,9] Allantoin helps repair the skin barrier,[10] while rosmarinic acid can increase skin hydration, reduce trans-epidermal water loss (TEWL),[11] and inhibit growth of *S. aureus* and its methicillin-resistant variants, as well as control biofilm formation.[12,13]

Topical plant-derived oils have also been studied for skin health.[14-16] Sunflower oil has been found to support stratum corneum integrity and improve skin hydration,[17] and *Cedrus deodara* (cedarwood) wood oil has anti-inflammatory and anti-bacterial properties with the ability to inhibit microbial biofilms.[18]

In this study, we examine the combined effect of various plant-biotech-derived and cosmetic ingredients in a lotion and a gentle soap in adults with AD. Keeping the multifaceted nature of AD in mind, we investigate changes not only in AD severity, pruritus, and skin biophysical features, but also the impact on the skin microbiome, and changes in positive and negative effect.

2. MATERIALS AND METHODS

2.1. INVESTIGATIONAL PRODUCT AND APPLICATION

The moisturizer used was Bia Eczema Relief Lotion (Codex Labs, San Jose, CA). It contains: 1% colloidal oatmeal, aqua, *Helianthus annuus* seed oil, propanediol, glyceryl stearate, glycerin, *Lactobacillus* ferment, C13-15 alkane, cetyl alcohol, *Calendula officinalis* meristem cell extract, *Haberlea rhodopensis* leaf cell extract, *Padina pavonica thallus* extract, *Symphytum officinale* leaf extract, *Cocos nucifera* fruit extract, *Butyrospermum parkii* (shea) butter, *Moringa oleifera* seed oil, *Limnanthes alba* seed oil, *Macadamia integrifolia* seed oil, *Cedrus deodara* wood oil, hydrogenated lecithin, phytosphingosine, hydrolyzed sodium hyaluronate, ceramide NP, sodium phytate, sclerotium gum, xanthan gum, sodium benzoate, potassium sorbate, citric acid.

The soap used was Bia Unscented Soap (Codex Labs, San Jose, CA) and it contains: sodium olivate, sodium cocoate, sodium shea butterate, aqua, *Daucus carota sativa* root extract, sodium castorate, sodium sunflowerate, sodium cocoa butterate, *Calendula officinalis*.

Subjects were instructed to use the soap up to twice daily while bathing, and the moisturizer as needed. All investigational products were stored securely at room temperature.

2.2. ASSESSMENT OF MOISTURIZER IMPACT ON *S. EPIDERMIDIS* TO *S. AUREUS* RATIO

Test strain suspensions were freshly prepared from the log phase. A co-culture of the test microorganisms was prepared in a 1:10 ratio. For the test preparation, a master mix 75% ml PBS, 5% Tryptic soy (CASO) broth and 10% of the respective microbe suspension were mixed with 500 µl of the product.

Incubation took place under shaking 4 h ('leave on' products) at 32°C ± 2°C. Samples were plated and bacterial counts are determined in triplicates at time points t = 0 and t = 4 h, respectively. The CFU/ml and the ratios between product and control were then calculated.

2.3. INCLUSION AND EXCLUSION CRITERIA

Eligible participants were healthy male and female subjects, aged 18 years and older, with Fitzpatrick I to IV phototypes. Participants had active AD with a scoring atopic dermatitis (SCORAD) score between 25 and 50. Subjects were required to maintain their hygiene and makeup habits throughout the study. Exclusion criteria included pregnant or nursing women, and use of antibiotics or antifungal treatments to their body or scalp one month prior to enrollment.

2.4. STUDY DESIGN AND RECRUITMENT

This eight-week, open-label clinical trial took place between March and September 2024 in Malbork, Poland. It was conducted by EUROFINS Dermscan/Pharmascan (Gdańsk, Poland) in compliance with the Declaration of Helsinki (1964) and its subsequent amendments. The Internal Bioethics Committee at Dermscan Poland approved the protocol. Data collection followed the study protocol, current internal procedures, and Good Clinical Practice (GCP) guidelines (CPMP/ICH/135/95 [R2]. Written informed consent was obtained from all participants prior to enrollment. The study was registered retroactively on clinicaltrials.gov with identifier NCT06804070.

Participants meeting all criteria were enrolled in the study. Prior to the baseline (D0), all enrolled subjects completed a wash-out period, using the unscented soap twice daily for 2–3 days. Each participant acted as their own control throughout the study. During the study, participants were instructed to use the soap on the entire body twice daily (morning and evening) in replacement of their usual cleansing product. Subjects were instructed to use the moisturizer on the body, especially on active lesions of AD at least twice daily and as often as needed. However, for each subject, 1 area of the body with no active AD lesion, as selected by a dermatologist, was spared from moisturizer application. No modifications were made to the methods or trial outcomes after the study began, and it concluded once all participants completed the required visits. Study visits were scheduled at a standard interval (SI) screening, baseline (D0), week 4 (D28), and week 8 (D56).

2.5. CLINICAL MEASURES: SCORAD AND PRURITUS

SCORAD scores were assessed at D0 and D56, using a three-step process to evaluate the extent score (A), intensity score (B) and the pruritus/insomnia score (C). The total SCORAD score was calculated using the formula: A/5 + 7B/2 + C. The objective SCORAD (oSCORAD) score, which excludes the subjective components, was calculated using the formula: A/5 + 7B/2.

Additional measures of pruritus improvement assessed at D56 included the number of subjects achieving a 4-point reduction in the NRS the proportion of subjects with an NRS of 0 or 1, and the proportion of subjects reporting an

NRS of 0. The third method was a global assessment of pruritus, where subjects rated their pruritus severity on a scale of 0=no, 1=mild, 2=moderate, and 3=severe pruritus at the SI.

2.6. MEASUREMENTS OF THE BIOPHYSICAL PROPERTIES OF THE SKIN

All biophysical measurements were taken after subjects had a 15-minute period to acclimate to ambient conditions in a climate-controlled room.[19] Measurements were collected at SI on predetermined skin areas, including one treated area with an active lesion and one non-treated area without a lesion. The following biophysical properties were assessed: trans-epidermal water loss (TEWL) using a Tewameter® (Courage + Khazaka, Köln, Germany), skin hydration using a Corneometer® (Courage + Khazaka, Köln, Germany), and squamae surface area (SSS) in mm^2 and desquamation index (DI) using D-Squame® (Clinical and Derm LLC, Dallas, TX, USA).

2.7. POSITIVE AND NEGATIVE AFFECT SCHEDULE (PANAS)

PANAS is a validated patient-oriented questionnaire that measures positive and negative effects.[20] Participants were asked to evaluate the degree to which they experienced effective components over the past week: Interested, Distressed, Excited, Upset, Strong, Guilty, Scared, Hostile, Enthusiastic, Proud, Irritable, Alert, Ashamed, Inspired, Nervous, Determined, Attentive, Jittery, Active, and Afraid. A 5-point scale was used for responses, ranging from 1 (very slightly or not at all) to 5 (extremely).

2.8. PHOTOGRAPHS

Two macrophotographs of selected areas were taken using a Nikon D90 camera at D0, D28, and D56. One selected area was a treated area with an AD active lesion (hand or arm or around the elbow), and the other selected area was a non-treated area without an AD lesion.

2.9. STATISTICAL ANALYSIS

Differences in SCORAD scores, pruritus responses, TEWL, hydration, SSS, and DI were analyzed using a paired Student t-test for parametric measures. Non-parametric data were evaluated using the Wilcoxon rank-sum analysis. A p-value < 0.05 was deemed statistically significant. All comparisons were made within groups, with baseline data serving as the control.

3. RESULTS

3.1. EX VIVO ASSESSMENT OF *S. EPIDERMIDIS* TO *S. AUREUS* RATIO

Incubation with the moisturizer in the ex vivo assay showed that the moisturizer promoted an increased ratio of *S. epidermidis* to *S. aureus* by 1.5-fold (Figure 1).

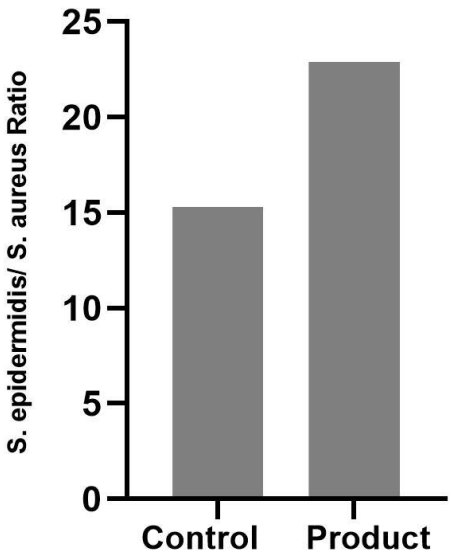

Figure 1. Assessment of the impact of the moisturizer on the ratio of *S. epidermidis* to *S. aureus* in bacterial culture. The moisturizer exhibited a 1.5-fold increased ratio in comparison to the control.

3.2. CLINICAL STUDY AND SCORAD

Of the 34 participants enrolled, 71% were female (n=24) and 29% were male (n=10). The mean age of participants was 32 years (range, 22-52). Of all participants, 26% (n=9) and 74% (n=25) had Fitzpatrick skin types I and II, respectively. The average total SCORAD at D0 was 29.8 (range, 25-46). The flow of participants throughout the study is shown in Figure 2. Thirty-three subjects completed the entire study.

Total and objective SCORAD scores were evaluated at D0 and D56. The mean total SCORAD scores were 29.8 and 1.7, representing a 99% reduction ($p < 0.0001$, Figure 3A). The mean oSCORAD scores were 23.1 and 1.4, representing a 94% reduction ($p < 0.0001$, Figure 3B). At D56, 91%, 88%, 85%, and 85% of participants achieved oSCORAD50 (50% reduction in oSCORAD compared to D0), oSCORAD75, oSCORAD90, and oSCORAD100, respectively (Figure 3C).

3.3. PRURITUS

The mean pruritus NRS reduced from 4.2 to 0.3 ($p < 0.0001$) between D0 and D56 (Figure3A). The proportion of subjects at D56 that achieved a 4-point reduction in their NRS was 91%, an NRS of 0 or 1 was 94%, and an NRS of 0 was 79% (Figure 4B). The subject global assessment of pruritus revealed a significant reduction ($p < 0.0001$) at both D28 and D56 (Figure 4C).

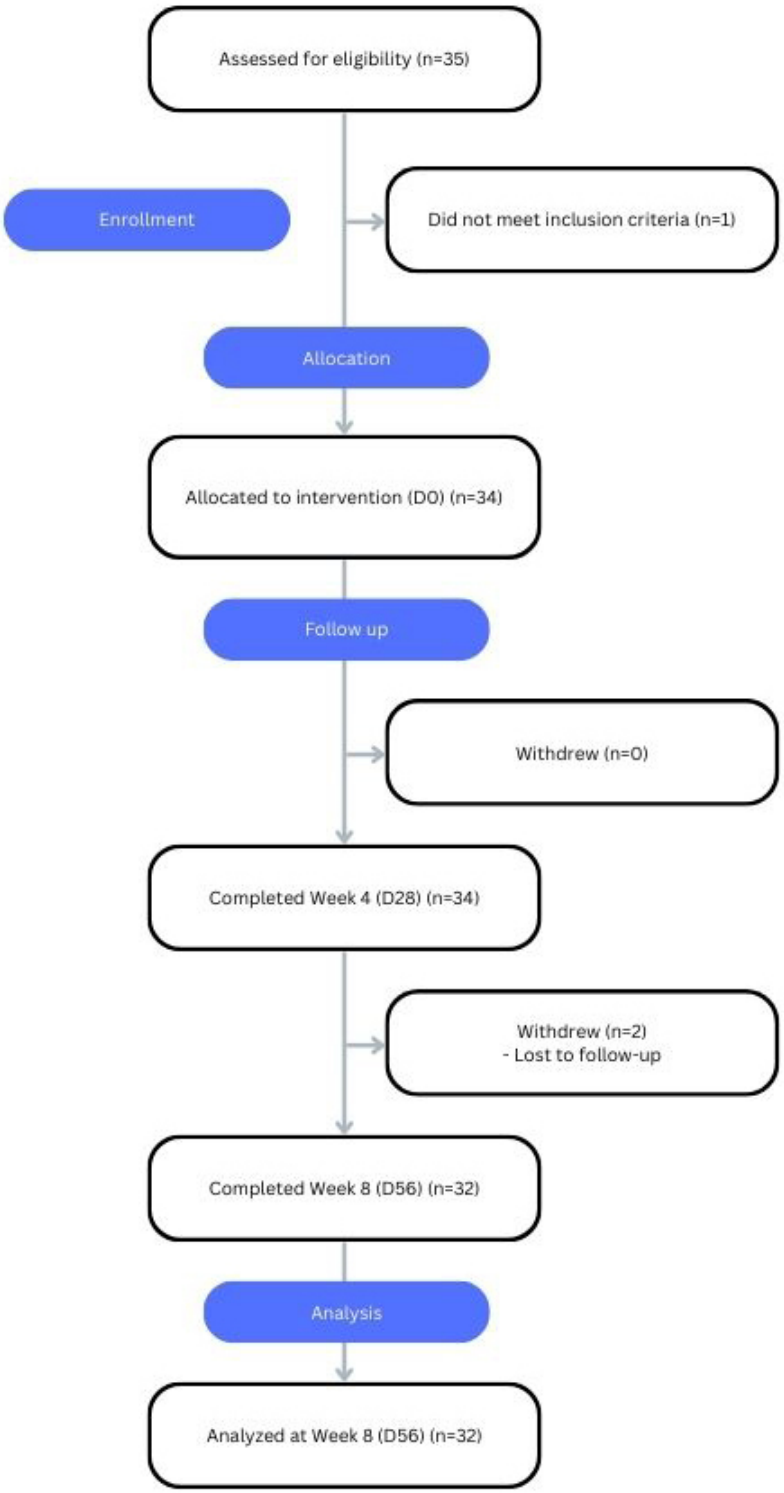

Figure 2. CONSORT (Consolidated Standards of Reporting Trials) Flow Diagram

3.4. SKIN BIOPHYSICAL PARAMETERS

3.4.1. TEWL

The TEWL decreased significantly in lesional skin by 22% ($p < 0.0001$) and 40% ($p = 0.002$) at D28 and D56, respectively. On non-lesional skin, there were no significant changes to TEWL. See Figure 5A.

3.4.2. SKIN HYDRATION

On lesional skin, the skin hydration increased significantly by 42% ($p < 0.0001$) and 78% ($p < 0.0001$) at D28 and D56,

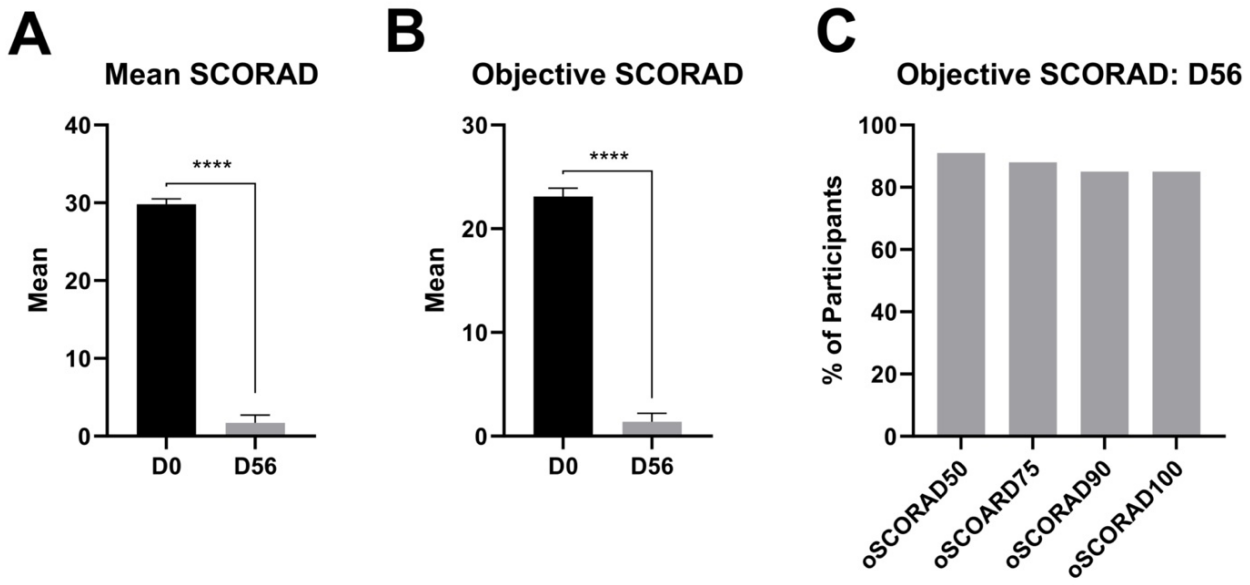

Figure 3. A) Mean SCORAD (SCORing Atopic Dermatitis) scores at D0 and D56. B) Mean objective SCORAD (oSCORAD) scores at D0 and D56. C) Percent of participants achieving oSCORAD50 (50% reduction in oSCORAD compared to D0), oSCORAD75, oSCORAD90, and oSCORAD100 at D56.

****=p < 0.0001

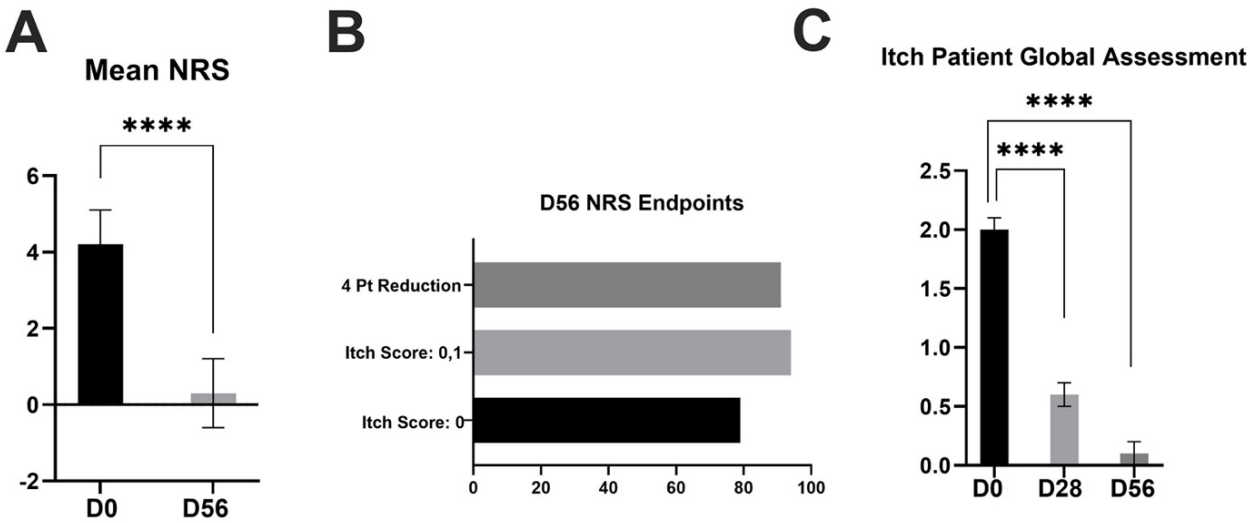

Figure 4. A) Mean Pruritus Numeric Rating Scale (NRS) scores at D0 and D56. B) Percent of participants achieving NRS endpoints (4-point reduction, pruritus score of 0 or 1, and pruritus score of 0) at D56. C) Mean Pruritus Patient Global Assessment scores at D0, D28, and D56.

****=p < 0.0001

respectively. On non-lesional skin, skin hydration showed no significant changes. See Figure 5B.

3.4.3. DESQUAMATION MEASURES

The surface occupied by squamae (in mm^2) in lesional skin decreased significantly by 49% ($p < 0.0001$) and 64% ($p < 0.0001$) at D28 and D56, respectively. At the control site, the surface occupied by squamae significantly decreased by 32% ($p = 0.03$) at D28 and decreased by 44% ($p = 0.01$) at D56. See Figure 5C.

The desquamation index in lesional skin decreased significantly by 51% ($p < 0.0001$) and 65% ($p < 0.0001$) at D28 and D56, respectively. At the control site, the desquamation index significantly decreased by 32% ($p = 0.03$) at D28 and by 45% ($p = 0.01$) at D56. See Figure 5D.

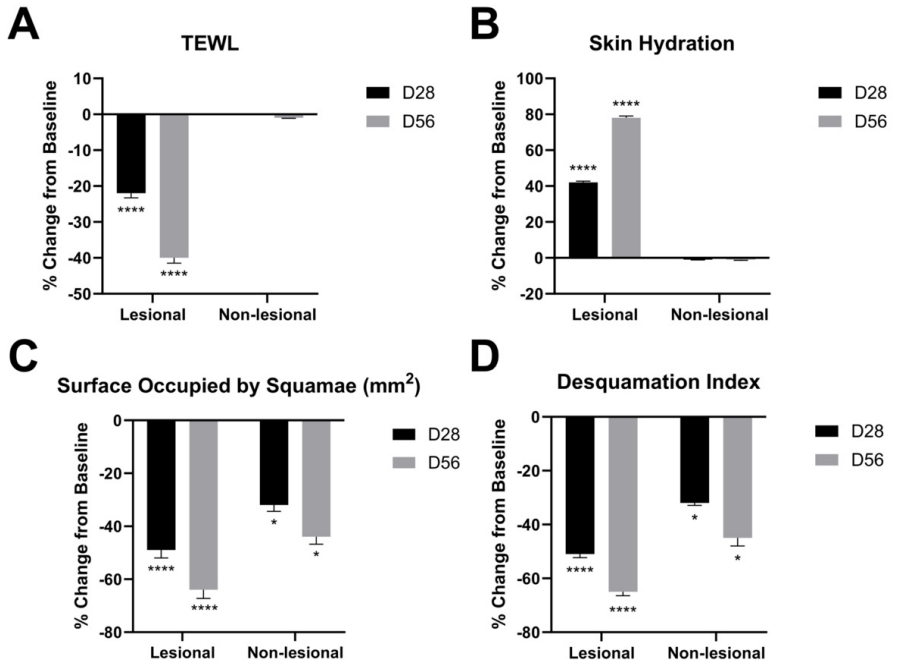

Figure 5. A) Percent change in transepidermal water loss (TEWL) from baseline (D0) to week 4 (D28) and week 8 (D56) on treated lesional and non-treated non-lesional skin. B) Percent change in skin hydration from D0 to D28 and D56 on lesional and non-lesional skin. C) Percent change in surface occupied by squamae (in mm^2) from D0 to D28 and D56 on lesional and non-lesional skin. D) Percent change in desquamation index from D0 to D28 and D56 on lesional and non-lesional skin.

*= $p < 0.05$, ****= $p < 0.0001$

3.5. POSITIVE AND NEGATIVE AFFECT SCHEDULE (PANAS)

There were no significant changes seen in the overall or component positive affect scores. However, the overall negative affect score decreased at D56 ($p < 0.07$, Figure 6A), and significant improvements were observed in two negative affect components (Figure 6B). More specifically, there was a significant decrease in distress ($p < 0.008$) and upset ($p = 0.046$).

3.6. PHOTOGRAPHS

Photographs of active AD sites treated with the moisturizer and soap are shown in Figures 7 and 8.

3.7. ADVERSE EVENTS

During the study, 5 participants experienced an adverse event. Adverse events included throat infection, three headaches, and a toothache. Each event was self-limiting and not deemed to be related to the studied products. None of these adverse events led to an interruption in study protocol or withdrawal.

4. DISCUSSION

The efficacy of this novel topical treatment can be attributed to ingredients in both the soap and the moisturizer. Although the use of cleansing bars can disrupt the skin barrier, this soap was cold-processed, which has been shown to allow high glycerin content, a lower pH (7-8), a less irritating mix of fatty acids, and improved sensory perception.[21] It contained AD-supporting emollients like sunflower seed oil, coconut and shea butters, as well as carrot and calendula extracts.[22]

The use of sunflower seed oil as the principal carrier and penetration enhancer further improves the results with hydration and skin barrier protection, attributed to its linoleic and oleic acid content, and reduction of TEWL.[23,24] Additionally, it is rich in vitamins C, D, E, and beta-carotene, contains omega-6 fatty acids to help moisturize without irritation, and has demonstrated wound healing properties.[25,26]

Coconut fruit extract has high levels of polyphenols, antioxidants, and helps repair the skin barrier.[15] *M. oleifera* seed oil has a high composition of tocopherol, sterols, and oleic acid.[27,28] The antioxidant effects of *M. oleifera* seed oil provide protection from oxidative stressors and increase skin hydration.[27,28] It may also relieve AD symptoms by reducing the expression of inflammatory mediators like IL-1β, TNF-α, IL-6, and CCL17 and inhibiting the activation of the NLRP3 inflammasome.[29]

The plant-biotech actives in the moisturizer may contribute to improvements in eczema through reducing inflammation and oxidative stress that may be associated with AD.[30] For example, *Calendula officinalis* contains antioxidants, tocopherol, carotenoids, flavonoids, coumarins,

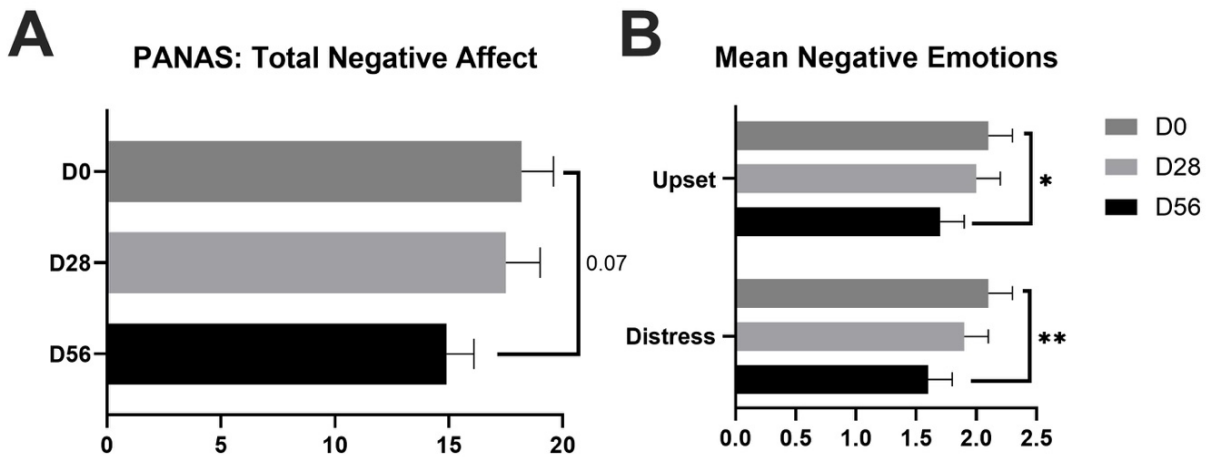

Figure 6. A) Total negative affect score as measured by the Negative Affect Schedule of the PANAS (Positive and Negative Affect Schedule) at D0, D28, and D56. B) Mean scores for negative emotions "upset" and "distress" at D0, D28, and D56.

*= $p < 0.05$

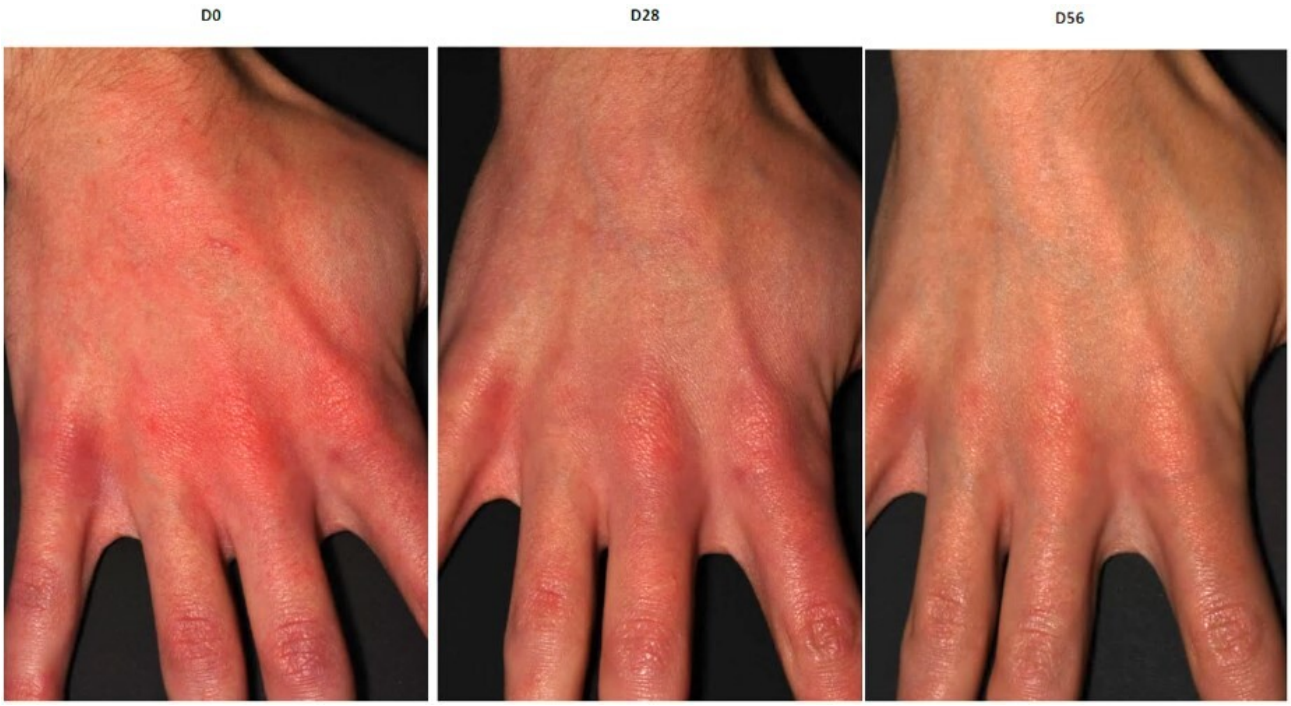

Figure 7. Image of the hand at D0, D28, and D56

and protoquinone.[31] These molecules aid skin barrier repair and are anti-inflammatory.[31,32] The stabilization of the skin barrier, as noted through the reduction of the desquamation index, may also reflect the efficacy of myconoside in *Haberlea rhodopensis* that has been shown to strongly stimulate extracellular matrix synthesis, thereby improving skin barrier cohesion, while laminarins, fucoidans, and alginic acids in *Pavonica* moisturize and prevent dryness and cracking.[33-35] The hyaluronic acid and ceramide NP in the moisturizer also contain functional actives for hydration and barrier repair.[36-38]

In addition, the rosmarinic acid from *Symphytum officinale* extract has previously been shown to acidify the stratum corneum which reduces the activity of desmosome degrading serine proteases.[11] Its high allantoin content may reduce redness, swelling, and pruritus, and support exfoliation.[39] A recent clinical study revealed that a 5% allantoin concentration had significant wound-healing effects by

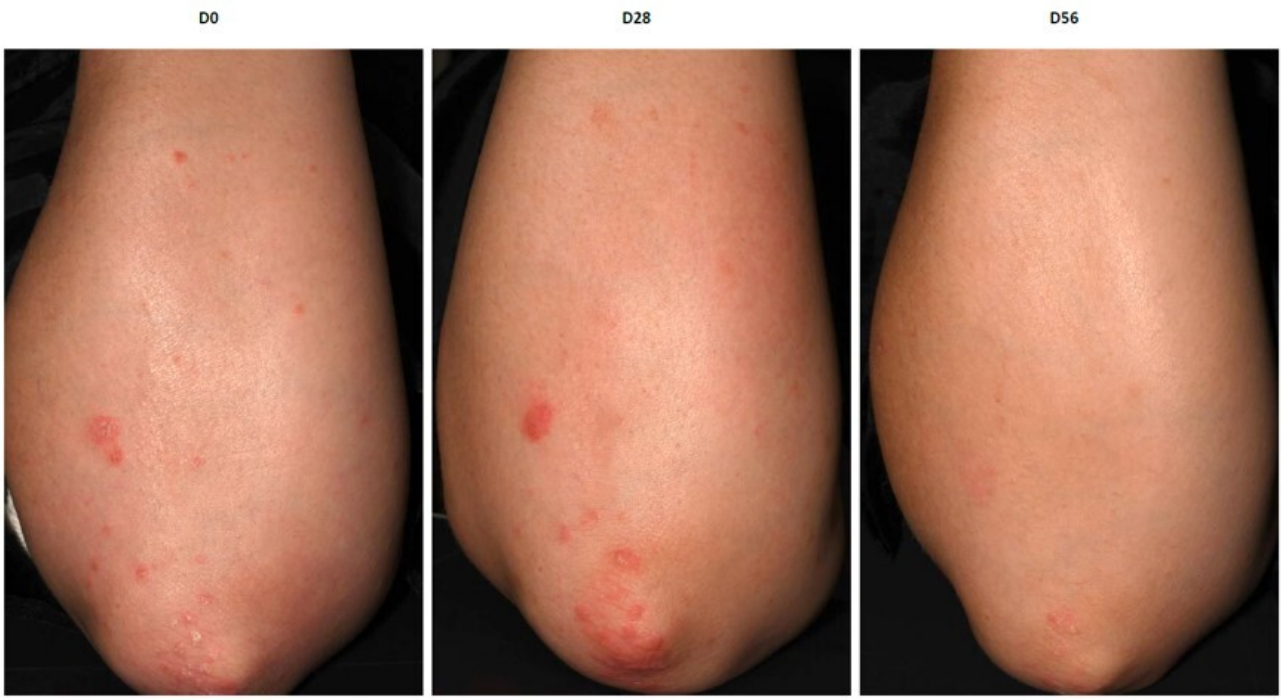

Figure 8. Image of the elbow at D0, D28, and D56.

promoting fibroblastic proliferation and extracellular matrix.[40]

The preservation system used in the moisturizer consists of *Lactobacillus* biotech ferments, coconut oil, edible organic acids, and a propanediol adjuvant.[41] *Lactobacillus* ferments contain bacteriocins and antimicrobial peptides which prevent the growth of pathogenic microbes.[42-44] The coconut oil provides anti-fungal and anti-viral protection, and helps mitigate *S. aureus* infection,[45] one cause of AD flares,[46] and pruritus.[47,48] The preservative system has been shown to not adversely affect skin microbiome diversity, and also functions as an emollient and humectant.[41]

The reductions in SCORAD index and pruritus NRS reflect the synergy between the plant-biotech ingredients in the moisturizer and soap. Previous work that assessed the impact of the specific plant-biotech actives on skin cells revealed that they reduced the gene expression of interleukin-4 (IL-4) in skin cells while increasing the expression of structural protein genes.[49,50] Since IL-4 is one of the main drivers in type 2 inflammation in AD and pruritus, this agrees with the reduction in both AD severity and in pruritus found in this study.[51]

Though this study did not demonstrate significant improvement in positive affect, as measured by the PANAS questionnaire, there was improvement in overall negative affect, and a significant reduction in distress and upset. These improvements in mood may be attributed to the significant reductions in pruritus, which US adults with AD report to be one of their most burdensome symptoms.[52] Because 81% of AD patients have reported that stress worsens their pruritus,[53] it is possible that reduction of distress contributed to improvements in pruritus and skin parameters.

There are several limitations to note. The sample size was small with a female majority and Fitzpatrick I-II types. Therefore, the results warrant future studies in a larger population with more males and higher Fitzpatrick phototypes. This study utilized the SCORAD scoring system instead of the total body EASI for assessment of the AD, but this allowed for differentiation between the total and the objective SCORAD scores as well as for assessment of pruritus. Additionally, the composition of the moisturizer and soap did not allow for assessment of individual ingredients. In future clinical trials, a head-to-head study comparing these study products to traditionally used topical moisturizers and soaps, or to other plant-based topicals will be helpful in understanding the relative efficacy of non-prescription topicals on AD. Lastly, this study was limited to those with mild-to-moderate AD and no conclusions can be made about the impact of the moisturizer and soap in those with severe AD.

5. CONCLUSION

The results of this study showed significant reduction in disease severity in patients with

mild to moderate AD. These findings suggest that the plant-biotech moisturizer and soap effectively restore skin barrier and alleviate AD symptoms. The results also show improvement in skin barrier structural integrity as evidenced by desquamation index reduction and beneficial changes in skin biophysical properties. Further studies that expand the study population and include assessments of the local microbiome are warranted.

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None

AUTHOR DISCLOSURES

JM reports serving as a consultant for Codex Labs (stockholder). PAL reports being on the speaker's bureau for AbbVie, Arcutis, Eli Lilly, Galderma, Hyphens Pharma, Incyte, La Roche-Posay/L'Oréal, Pfizer, Pierre-Fabre Dermatologie, Regeneron/Sanofi Genzyme, Verrica; reports consulting/advisory boards for Alphyn Biologics (stock options), AbbVie, Almirall, Amyris, Arcutis, ASLAN, Bristol-Myers Squibb, Burt's Bees, Castle Biosciences, Codex Labs (stock options), Concerto Biosci (stock options), Dermavant, Eli Lilly, Galderma, Janssen, LEO Pharma, Lipidor, L'Oréal, Merck, Micreos, MyOR Diagnostics, Regeneron/Sanofi Genzyme, Sibel Health, Skinfix, Suneco Technologies (stock options), Soteri Skin (stock options), Theraplex, UCB, Unilever, Verdant Scientific (stock options), Verrica, Yobee Care (stock options). In addition, Dr. Lio has a patent pending for a Theraplex product with royalties paid and is a Board member and Scientific Advisory Committee Member emeritus of the National Eczema Association. RKS reports serving as an advisor for LearnHealth, Arbonne, and Codex Labs, and Trace Minerals and has served as a consultant or speaker for Burt's Bees, Novozymes, Almirall, Novartis, Incyte, Lilly, Sanofi, Bristol Myers Squibb, Pfizer, Nutrafol, Galderma, Abbvie, Leo, UCB, Sun, and Regeneron Pharmaceuticals.

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REFERENCES

1. Brown SJ. Atopic eczema. *Clinical Medicine*. 2016;16(1):66-69. doi:10.7861/clinmedicine.16-1-66

2. Nemeth V, Syed HA, Evans J. Eczema. In: *StatPearls*. StatPearls Publishing; 2025. Accessed September 7, 2025. http://www.ncbi.nlm.nih.gov/books/NBK538209/

3. Khadka VD, Key FM, Romo-González C, et al. The Skin Microbiome of Patients With Atopic Dermatitis Normalizes Gradually During Treatment. *Front Cell Infect Microbiol*. 2021;11:720674. doi:10.3389/fcimb.2021.720674

4. Bjerre RD, Bandier J, Skov L, Engstrand L, Johansen JD. The role of the skin microbiome in atopic dermatitis: a systematic review. *Br J Dermatol*. 2017;177(5):1272-1278. doi:10.1111/bjd.15390

5. Cheng BT, Silverberg JI. Depression and psychological distress in US adults with atopic dermatitis. *Annals of Allergy, Asthma & Immunology*. 2019;123(2):179-185. doi:10.1016/j.anai.2019.06.002

6. Garg A, Chren MM, Sands LP, et al. Psychological Stress Perturbs Epidermal Permeability Barrier Homeostasis: Implications for the Pathogenesis of Stress-Associated Skin Disorders. *Arch Dermatol*. 2001;137(1). doi:10.1001/archderm.137.1.53

7. Frazier W, Bhardwaj N. Atopic Dermatitis: Diagnosis and Treatment. *Am Fam Physician*. 2020;101(10):590-598.

8. Dawid-Pać R. Medicinal plants used in treatment of inflammatory skin diseases. *pdia*. 2013;3:170-177. doi:10.5114/pdia.2013.35620

9. Staiger C. Comfrey: A Clinical Overview. *Phytotherapy Research*. 2012;26(10):1441-1448. doi:10.1002/ptr.4612

10. Paller AS, Browning J, Nikolic M, et al. Efficacy and tolerability of the investigational topical cream SD-101 (6% allantoin) in patients with epidermolysis bullosa: a phase 3, randomized, double-blind, vehicle-controlled trial (ESSENCE study). *Orphanet J Rare Dis*. 2020;15(1):158. doi:10.1186/s13023-020-01419-3

11. Jung SW, Park GH, Kim E, et al. Rosmarinic Acid, as an NHE1 Activator, Decreases Skin Surface pH and Improves the Skin Barrier Function. *IJMS*. 2022;23(7):3910. doi:10.3390/ijms23073910

12. Ekambaram S, Perumal S, Balakrishnan A, Marappan N, Gajendran S, Viswanathan V. Antibacterial synergy between Rosmarinic acid and antibiotics against Methicillin resistant Staphylococcus aureus. *J Intercult Ethnopharmacol*. 2016;5(4):358. doi:10.5455/jice.20160906035020

13. Slobodníková L, Fialová S, Hupková H, Grancai D. Rosmarinic acid interaction with planktonic and biofilm *Staphylococcus aureus*. *Nat Prod Commun*. 2013;8(12):1747-1750. doi:10.1177/1934578X1300801223

14. Evangelista MTP, Abad-Casintahan F, Lopez-Villafuerte L. The effect of topical virgin coconut oil on SCORAD index, transepidermal water loss, and skin capacitance in mild to moderate pediatric atopic dermatitis: a randomized, double-blind, clinical trial. *Int J Dermatol*. 2014;53(1):100-108. doi:10.1111/ijd.12339

15. Nadora D, Burney W, Chaudhuri RK, et al. Prospective Randomized Double-Blind Vehicle-Controlled Study of Topical Coconut and Sunflower Seed Oil-Derived Isosorbide Diesters on Atopic Dermatitis. *Dermatitis®*. 2024;35(S1):S62-S69. doi:10.1089/derm.2023.0329

16. Dwiyana RF, Darmadji HP, Hidayah RMN, et al. THE BENEFICIAL EFFECT OF 20% SUNFLOWER SEED OIL CREAM ON MILD ATOPIC DERMATITIS IN CHILDREN. *Int J Pharm Pharm Sci*. Published online January 5, 2019:100-103. doi:10.22159/ijpps.2019v11i2.30707

17. Danby SG, AlEnezi T, Sultan A, et al. Effect of Olive and Sunflower Seed Oil on the Adult Skin Barrier: Implications for Neonatal Skin Care. *Pediatric Dermatology*. 2013;30(1):42-50. doi:10.1111/j.1525-1470.2012.01865.x

18. Kačániová M, Galovičová L, Valková V, et al. Chemical Composition, Antioxidant, In Vitro and In Situ Antimicrobial, Antibiofilm, and Anti-Insect Activity of Cedar atlantica Essential Oil. *Plants*. 2022;11(3):358. doi:10.3390/plants11030358

19. Humbert P, Fanian F, Maibach H, Agache A. *Agache's Measuring the Skin: Non-Invasive Investigations, Physiology, Normal Constants*. 2nd ed. Springer; 2017. doi:10.1007/978-3-319-32383-1

20. Watson D, Clark LA, Tellegen A. Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*. 1988;54(6):1063-1070. doi:10.1037/0022-3514.54.6.1063

21. Prieto Vidal N, Adeseun Adigun O, Pham TH, et al. The Effects of Cold Saponification on the Unsaponified Fatty Acid Composition and Sensory Perception of Commercial Natural Herbal Soaps. *Molecules*. 2018;23(9):2356. doi:10.3390/molecules23092356

22. Mandrich L, Esposito AV, Costa S, Caputo E. Chemical Composition, Functional and Anticancer Properties of Carrot. *Molecules*. 2023;28(20):7161. doi:10.3390/molecules28207161

23. Fecker R, Magyari-Pavel IZ, Cocan I, et al. Oxidative Stability and Protective Effect of the Mixture between Helianthus annuus L. and Oenothera biennis L. Oils on 3D Tissue Models of Skin Irritation and Phototoxicity. *Plants*. 2022;11(21):2977. doi:10.3390/plants11212977

24. Danby SG, AlEnezi T, Sultan A, et al. Effect of Olive and Sunflower Seed Oil on the Adult Skin Barrier: Implications for Neonatal Skin Care. *Pediatric Dermatology*. 2013;30(1):42-50. doi:10.1111/j.1525-1470.2012.01865.x

25. Lin TK, Zhong L, Santiago J. Anti-Inflammatory and Skin Barrier Repair Effects of Topical Application of Some Plant Oils. *IJMS*. 2017;19(1):70. doi:10.3390/ijms19010070

26. Guo S, Ge Y, Na Jom K. A review of phytochemistry, metabolite changes, and medicinal uses of the common sunflower seed and sprouts (Helianthus annuus L.). *Chemistry Central Journal*. 2017;11(1):95. doi:10.1186/s13065-017-0328-7

27. Cervera-Chiner L, Pageo S, Juan-Borrás M, García-Mares FJ, Castelló ML, Ortolá MD. Fatty Acid Profile and Physicochemical Properties of Moringa oleifera Seed Oil Extracted at Different Temperatures. *Foods*. 2024;13(17):2733. doi:10.3390/foods13172733

28. Baldisserotto A, Barbari R, Tupini C, et al. Multifunctional Profiling of Moringa oleifera Leaf Extracts for Topical Application: A Comparative Study of Different Collection Time. *Antioxidants*. 2023;12(2):411. doi:10.3390/antiox12020411

29. Kim KM, Kim SY, Mony TJ, et al. Moringa concanensis L. Alleviates DNCB-Induced Atopic Dermatitis-like Symptoms by Inhibiting NLRP3 Inflammasome-Mediated IL-1β in BALB/c Mice. *Pharmaceuticals*. 2022;15(10):1217. doi:10.3390/ph15101217

30. Bertino L, Guarneri F, Cannavò SP, Casciaro M, Pioggia G, Gangemi S. Oxidative Stress and Atopic Dermatitis. *Antioxidants*. 2020;9(3):196. doi:10.3390/antiox9030196

31. Shahane K, Kshirsagar M, Tambe S, et al. An Updated Review on the Multifaceted Therapeutic Potential of Calendula officinalis L. *Pharmaceuticals*. 2023;16(4):611. doi:10.3390/ph16040611

32. Preethi KC, Kuttan R. Wound healing activity of flower extract of Calendula offlcinalis. *Journal of Basic and Clinical Physiology and Pharmacology*. 2009;20(1):73-80. doi:10.1515/JBCPP.2009.20.1.73

33. Dell'Acqua G, Schweikert K. Skin benefits of a myconoside-rich extract from resurrection plant *Haberlea rhodopensis*. *Intern J of Cosmetic Sci*. 2012;34(2):132-139. doi:10.1111/j.1468-2494.2011.00692.x

34. Staneva D, Dimitrova N, Popov B, Alexandrova A, Georgieva M, Miloshev G. Haberlea rhodopensis Extract Tunes the Cellular Response to Stress by Modulating DNA Damage, Redox Components, and Gene Expression. *IJMS*. 2023;24(21):15964. doi:10.3390/ijms242115964

35. Kordjazi M, Shabanpour B, Zabihi E, et al. Investigation of effects of fucoidan polysaccharides extracted from twospecies of Padina on the wound-healing process in the rat. *Turk J Vet Anim Sci*. 2017;41:106-117. doi:10.3906/vet-1603-21

36. Draelos ZD. A clinical evaluation of the comparable efficacy of hyaluronic acid-based foam and ceramide-containing emulsion cream in the treatment of mild-to-moderate atopic dermatitis: Barrier restoration therapy in atopic dermatitis. *Journal of Cosmetic Dermatology*. 2011;10(3):185-188. doi:10.1111/j.1473-2165.2011.00568.x

37. Spada F, Harrison IP, Barnes TM, et al. A daily regimen of a ceramide-dominant moisturizing cream and cleanser restores the skin permeability barrier in adults with moderate eczema: A randomized trial. *Dermatologic Therapy*. 2021;34(4). doi:10.1111/dth.14970

38. Osher GR, Madkins K, Lio P. Efficacy of Over-the-Counter Moisturizers in Pediatric Atopic Dermatitis: An Update to a Systematic Review. *Curr Derm Rep*. 2024;13(4):236-247. doi:10.1007/s13671-024-00453-9

39. Vanessa VV, Wan Ahmad Kammal WSL, Lai ZW, How KN. A Review of Moisturizing Additives for Atopic Dermatitis. *Cosmetics*. 2022;9(4):75. doi:10.3390/cosmetics9040075

40. Araújo LU, Grabe-Guimarães A, Mosqueira VCF, Carneiro CM, Silva-Barcellos NM. Profile of wound healing process induced by allantoin. *Acta Cir Bras*. 2010;25(5):460-461. doi:10.1590/S0102-86502010000500014

41. Cornell M, Paldus B. PRESERVATIVE SYSTEMS AND COMPOSITIONS AND METHODS INCORPORATING SAME. Published online November 12, 2020:26.

42. Lee GR, Maarouf M, Hendricks AJ, Lee DE, Shi VY. Topical probiotics: the unknowns behind their rising popularity. *Dermatol Online J*. 2019;25(5). doi:10.5070/D3255044062

43. Habeebuddin M, Karnati RK, Shiroorkar PN, et al. Topical Probiotics: More Than a Skin Deep. *Pharmaceutics*. 2022;14(3):557. doi:10.3390/pharmaceutics14030557

44. Darmstadt G, Mao-Qiang M, Chi E, et al. Impact of topical oils on the skin barrier: possible implications for neonatal health in developing countries. *Acta Paediatrica*. 2002;91(5):546-554. doi:10.1111/j.1651-2227.2002.tb03275.x

45. Mahaklan L, Pratuangdejkul J, Satitpatipan V. Antimicrobial effect of coconut oil on Staphylococcus aureus: an implication of Staphylococcus epidermidis induced fermentation. *LSMB*. 2022;6(1). doi:10.28916/lsmb.6.1.2022.100

46. Kong HH, Oh J, Deming C, et al. Temporal shifts in the skin microbiome associated with disease flares and treatment in children with atopic dermatitis. *Genome Res*. 2012;22(5):850-859. doi:10.1101/gr.131029.111

47. Deng L, Costa F, Blake KJ, et al. S. aureus drives itch and scratch-induced skin damage through a V8 protease-PAR1 axis. *Cell*. 2023;186(24):5375-5393.e25. doi:10.1016/j.cell.2023.10.019

48. Du Toit A. *Staphylococcus aureus* gets itchy. *Nat Rev Microbiol*. 2024;22(2):61-61. doi:10.1038/s41579-023-01000-2

49. Ryan T, Cornell M, Barbara P. COMPOSITIONS AND METHODS FOR TREATING SKIN. Published online June 16, 2020:17.

50. Zhao J, Yue Y, Li X, Li D, Zhao P, Tian X. Antioxidative hydrogel based on hyaluronic acid/polyethylene glycol loaded with shikonin-coated flexible liposome and evaluation of its therapeutic effect on eczema. *International Journal of Biological Macromolecules*. 2024;283:137727. doi:10.1016/j.ijbiomac.2024.137727

51. Hassoun D, Malard O, Barbarot S, Magnan A, Colas L. Type 2 immunity-driven diseases: Towards a multidisciplinary approach. *Clin Experimental Allergy*. 2021;51(12):1538-1552. doi:10.1111/cea.14029

52. Silverberg JI, Gelfand JM, Margolis DJ, et al. Patient burden and quality of life in atopic dermatitis in US adults. *Annals of Allergy, Asthma & Immunology*. 2018;121(3):340-347. doi:10.1016/j.anai.2018.07.006

53. Wahlgren CF. Pathophysiology of itching in urticaria and atopic dermatitis. *Allergy*. 1992;47(2PART1):65-75. doi:10.1111/j.1398-9995.1992.tb05091.x