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Effects of a leave-on scalp serum based on Acorus (changpo) rhizome water on scalp erythema, scaling, pruritus, hydration and transepidermal water loss: a 2-week, open-label, single-arm study in Korean women

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Research Article

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Effects of a leave-on scalp serum based on *Acorus* (changpo) rhizome water on scalp erythema, scaling, pruritus, hydration and transepidermal water loss: a 2-week, open-label, single-arm study in Korean women

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Abstract

Background: Scalp dryness, scaling and pruritus are common cosmetic complaints and have been associated with impaired stratum corneum barrier function. Leave-on formulations remain on the scalp between washes and may therefore be suitable for barrier-supportive care.

Objective: To evaluate changes in scalp erythema, scaling, pruritus, stratum corneum hydration and transepidermal water loss (TEWL) during 2 weeks of use of a water-based leave-on scalp serum containing *Acorus* (changpo) rhizome water, niacinamide and panthenol.

Methods: In this open-label, single-arm study, 23 women aged 20 to 59 years with visible scalp erythema and scaling applied the serum twice daily for 2 weeks. Erythema (a* value) and scale area were assessed by image analysis of 80× magnified scalp images, pruritus by a 10-cm visual analogue scale (VAS), and stratum corneum hydration and TEWL using a Corneometer CM825 and a Tewameter TM300, respectively, at baseline and week 2.

Results: Twenty-two participants (mean age, 51.0 ± 3.6 years) completed the study. At week 2, mean scalp erythema had decreased by 84.2% (from 5.27 ± 2.70 to 0.83 ± 0.79), scale area by 77.9%, pruritus VAS by 54.9% (from 7.26 ± 1.02 to 3.28 ± 1.86 cm) and TEWL by 27.2% (from 15.87 ± 3.92 to 11.56 ± 2.64 g/h/m²), whereas stratum corneum hydration had increased by 48.3% (from 3.27 ± 2.42 to 4.84 ± 2.99 AU) (all $p < 0.001$). Erythema, scaling and pruritus improved in all 22 participants, and hydration and TEWL in 21 (95.5%). No adverse skin reactions were observed.

Conclusions: Twice-daily use of the serum for 2 weeks was associated with reduced scalp erythema, scaling and pruritus, together with increased stratum corneum hydration and decreased TEWL. Given the uncontrolled design and short duration, these findings should be regarded as preliminary and warrant confirmation in randomized, vehicle-controlled trials.

Keywords: scalp; dry scalp; pruritus; transepidermal water loss; skin barrier; stratum corneum hydration; *Acorus*; niacinamide; panthenol

1. Introduction

Scalp dryness, scaling and pruritus are among the most frequent cosmetic concerns related to the scalp. Scaling has been linked to stratum corneum dysfunction, including altered lipid composition and increased transepidermal water loss (TEWL) [1,2]. Because adequate stratum corneum hydration and an intact permeability barrier are

prerequisites for normal desquamation [1], topical products that hydrate the scalp and support barrier function represent a rational approach to the care of a dry, scaly and pruritic scalp.

Most scalp care products are rinse-off shampoos with limited contact time, whereas leave-on formulations remain on the skin between washes. Several ingredients commonly used in leave-on skin care have documented effects on barrier function. Niacinamide increases the biosynthesis of ceramides and other stratum corneum lipids and improves the epidermal permeability barrier [3], and dexpanthenol has been reported to improve stratum corneum hydration and to support barrier repair [4]. *Centella asiatica* extract is widely used in cosmetic formulations for its soothing properties [5]. *Acorus* rhizome (changpo) has traditionally been used for hair washing in Korea, and a botanical blend containing *Acorus calamus* root was recently evaluated in a scalp tonic in a single-arm clinical study [6].

This report describes a 2-week, open-label, single-arm study of a water-based leave-on scalp serum in which *Acorus* rhizome water replaces purified water as the principal ingredient. The objective was to quantify changes in scalp erythema, scaling, pruritus, stratum corneum hydration and TEWL in women with visible scalp erythema and scaling.

2. Materials and methods

2.1 Study design and setting

This open-label, single-arm, pre–post study was conducted at Cutis Biomedical Research Center Co., Ltd. (Seoul, Republic of Korea), a contract research organization specializing in dermatological testing, between April 29 and May 13, 2026 (study code CBRC-H-260429-44). The study was commissioned and funded by Dongeuimogam. A board-certified dermatologist served as the principal investigator. The target sample size (at least 20 participants) was based on the guideline of the Korean Ministry of Food and Drug Safety (MFDS) on test methods for the substantiation of cosmetic claims [10].

2.2 Ethics

The study protocol was reviewed by the Institutional Review Board of Cutis Biomedical Research Center, which determined that the study was exempt from review (exemption no. CTS-IRB-260429-IE34, April 24, 2026). The study was conducted in accordance with the relevant MFDS regulations, Good Clinical Practice and the standard operating procedures of the testing center. Written informed consent was obtained from all participants before enrollment.

2.3 Participants

Women aged 20 to 59 years with visible scalp erythema and scaling were eligible if they were in good general health without acute or chronic skin disease, provided written informed consent and were available for follow-up. Exclusion criteria were pregnancy, breastfeeding or planned pregnancy; use of topical corticosteroids for one month or longer to treat a skin disease; participation in a similar study within the previous 6 months; sensitive or hypersensitive skin; nevi, acne, erythema, telangiectasia or other abnormalities at the test site; use of cosmetics or drugs with similar effects at the test site within the previous 3 months; procedures at the test site within the previous 6 months; and any other condition that, in the opinion of the principal investigator, rendered the individual unsuitable.

2.4 Test product and application

The test product was a leave-on scalp serum in spray form, marketed in Korea as Dongeuimogam Changpo Mogeun Bichaek Scalp Tonic and in the United States as MOGAM Korean Changpo Scalp Serum (identical formula). Its ingredients, in descending order of concentration, were *Acorus* (changpo) rhizome water, water, butylene glycol, *Houttuynia cordata* extract, *Camellia sinensis* leaf extract, *Perilla frutescens* leaf extract, 1,2-hexanediol, niacinamide, salicylic acid, *Acorus* (changpo) root extract, *Centella asiatica* extract, panthenol (dexpanthenol), sodium phytate, arginine and caprylyl glycol. The formulation contains no ethanol or menthol.

Participants applied the serum twice daily for 2 weeks. At each application, 4 to 6 sprays were applied directly to the scalp along the hair part (to the damp scalp when applied after shampooing), followed by gentle tapping with the fingertips and air-drying or blow-drying at medium heat. The use of other products, treatments or procedures that could affect the results was prohibited during the study. Participants recorded each application in a compliance diary, and data from participants with less than 80% of the scheduled applications were to be excluded from analysis.

2.5 Outcome measures

All measurements were performed at baseline and at week 2. Before each measurement session, participants were acclimatized for 30 minutes at 23 ± 1 °C and 50 ± 5% relative humidity, and the same investigator measured the same scalp site.

- **Erythema:** the scalp was photographed at 80× magnification under normal light using a KONG camera (Bomtech Electronics, Korea), and the a* value of a defined region was analyzed with I-MAX Plus software (ING plus, Korea). Lower values indicate less erythema.
- **Scaling:** the same images were analyzed for the area covered by scales (Area value, I-MAX Plus). Lower values indicate less scaling.
- **Pruritus:** participants rated the intensity of itch experienced over the preceding 24 hours by marking a 10-cm visual analogue scale (VAS) [7].
- **Stratum corneum hydration:** measured by capacitance using a Corneometer CM825 (Courage + Khazaka electronic, Germany) and expressed in arbitrary units (AU); the mean of three readings was used [8].
- **TEWL:** measured using a Tewameter TM300 (Courage + Khazaka electronic, Germany) and expressed in g/h/m²; the mean of the last five stable readings was used [9].
- **Subjective assessment and tolerability:** at week 2, participants rated the improvement of each outcome on a 5-point scale. Adverse reactions were assessed by investigator visual examination and participant self-report.

2.6 Statistical analysis

Analyses were performed on the per-protocol population using SPSS Statistics 27. After assessment of normality, baseline and week-2 values were compared using the paired t-test or the Wilcoxon signed-rank test, as appropriate (Table 2). Statistical significance was set at $p < 0.05$. Exact two-sided p values were recalculated by the author from the individual participant data in the testing center's report using the same tests. Percentage change was calculated as the difference between group means relative to the baseline mean.

2.7 Use of AI tools

An AI-based writing assistant was used for drafting and language editing. The author verified all data against the original laboratory report and takes full responsibility for the content of this manuscript.

3. Results

3.1 Participants

Of the 23 women enrolled, one withdrew consent at the week-2 visit, and 22 (95.7%) completed the study and were included in the per-protocol analysis. The mean age of completers was 51.0 ± 3.6 years (range, 45 to 58 years) (Table 1).

Table 1. Baseline characteristics of participants who completed the study (n = 22)

Characteristic	Value
Female sex, n (%)	22 (100)
Age, years, mean ± SD (range)	51.0 ± 3.6 (45 to 58)
Age 40 to 49 years, n (%)	8 (36.4)

Age 50 to 59 years, n (%)	14 (63.6)
Scalp condition at enrollment	Visible erythema and scaling

3.2 Efficacy outcomes

All five outcomes improved significantly from baseline to week 2 (Table 2). Mean scalp erythema (a*) decreased from 5.267 to 0.833 (−84.2%), scale area from 13,997.6 to 3,094.0 (−77.9%) and pruritus VAS from 7.26 to 3.28 cm (−54.9%). Stratum corneum hydration increased from 3.27 to 4.84 AU (+48.3%), and TEWL decreased from 15.87 to 11.56 g/h/m² (−27.2%). Erythema, scaling and pruritus improved in all 22 participants (100%), and hydration and TEWL in 21 (95.5%).

Table 2. Scalp outcomes at baseline and after 2 weeks of twice-daily use (n = 22)

Outcome (unit)	Baseline	Week 2	Change	Improved, n (%)	Test	p value
Erythema (a*)	5.267 ± 2.700	0.833 ± 0.794	−84.2%	22 (100)	Wilcoxon	<0.001
Scale area (Area)	13,997.6 ± 4,746.5	3,094.0 ± 1,859.4	−77.9%	22 (100)	Paired t	<0.001
Pruritus (VAS, cm)	7.26 ± 1.02	3.28 ± 1.86	−54.9%	22 (100)	Paired t	<0.001
Hydration (AU)	3.27 ± 2.42	4.84 ± 2.99	+48.3%	21 (95.5)	Wilcoxon	<0.001
TEWL (g/h/m²)	15.87 ± 3.92	11.56 ± 2.64	−27.2%	21 (95.5)	Paired t	<0.001

Values are presented as mean ± standard deviation. Change denotes the difference between group means relative to the baseline mean. Improved denotes the number of participants whose values changed in the favorable direction. AU, arbitrary units; TEWL, transepidermal water loss; VAS, visual analogue scale.

3.3 Subjective assessment and tolerability

All participants rated each of the five outcomes (erythema, scaling, pruritus, hydration and moisture loss) 3 or higher on the 5-point scale. No adverse skin reactions were observed or reported during the study period.

4. Discussion

In this open-label study, 2 weeks of twice-daily application of a water-based leave-on scalp serum containing *Acorus* rhizome water was associated with marked reductions in scalp erythema, scaling and pruritus, accompanied by increased stratum corneum hydration and decreased TEWL. The concurrent increase in hydration and decrease in TEWL suggests an improvement in barrier function rather than a transient surface moisturizing effect alone. These observations are consistent with the reported effects of niacinamide on stratum corneum lipid synthesis [3] and of dexpanthenol on hydration and barrier repair [4], as well as with the concept that scaling reflects stratum corneum dysfunction [1,2]. The salicylic acid contained in the formulation may also have contributed to the reduction in scale area.

The contribution of individual ingredients cannot be determined from the present data. Because the serum combines *Acorus* rhizome water with several other active ingredients, the specific effect of *Acorus* cannot be isolated in a single-arm design.

This study has several limitations. First, the absence of a vehicle or untreated control group precludes causal inference; regression to the mean, seasonal variation and expectation effects cannot be excluded, particularly because participants were selected on the basis of visible erythema and scaling. Second, the study duration was short, and the persistence of the observed changes is unknown. Third, the sample was small and limited to Korean women aged 45 to 58 years, and individuals with sensitive skin were excluded, which limits generalizability. Fourth, outcome assessment was not blinded. Fifth, scale area derived from image analysis is not a validated clinical scaling score. Finally, the study was funded by the manufacturer of the test product. Randomized, vehicle-controlled studies of longer duration in more diverse populations are warranted.

5. Conclusions

In this 2-week, open-label, single-arm study, a water-based leave-on scalp serum containing *Acorus* rhizome water was associated with improvements in scalp erythema, scaling, pruritus, stratum corneum hydration and TEWL and was well tolerated. These preliminary findings support further evaluation in controlled trials.

Declarations

Conflict of interest: The author is the founder and chief executive officer of Dongeuimogam (MOGAM), which manufactures and markets the test product and commissioned and funded this study.

Funding: This study was funded by Dongeuimogam.

Ethics approval and consent to participate: The Institutional Review Board of Cutis Biomedical Research Center determined that the study was exempt from review (exemption no. CTS-IRB-260429-IE34). Written informed consent was obtained from all participants.

Data availability: Aggregate data are presented in this article. De-identified individual participant data are available from the corresponding author upon reasonable request.

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