

Tradename: AC AlfalfaBoost

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Lot #: N231107J

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Study Director: *Daniel Shill*

Principal Investigator: *Kayla Patterson*

Test Performed:

Scalp Sebum Reduction Study

Introduction

Sebum is the oily, waxy secretion of sebaceous glands helping to moisturize and protect the skin from bacterial and fungal pathogens. An insufficient amount of sebum can trigger dry, red, and itchy skin on the scalp whereas an overproduction of sebum leads to an oily scalp, increased presence of dandruff, and leaves a visible shine. The shiny and greasy appearance associated with excess sebum and oily skin is undesirable and reducing these attributes through cosmetic applications is highly sought after.

Accordingly, a scalp sebum reduction study was conducted to evaluate the ability of **AC AlfalfaBoost** to decrease sebum on the scalp while maintaining moisturization.

Study Principle

Initial photographs, sebum measurements, and hydration levels were recorded from the middle of participant's scalps. Following baseline measurements, half of the participants applied a control Base Shampoo and Base Conditioner to their scalp for two weeks, while the other half applied the 5.0% **AC AlfalfaBoost** in a Base Shampoo and Base Conditioner. Participants kept their normal haircare and washing routines with the products they currently use apart from replacing their current shampoo and conditioner with the supplied test products. After each week of product application, photographs, sebum measurements, and hydration levels were obtained.

Materials

- A. **Equipment:** DermaLab Skin Combo (Hydration Probe and DermaScope Camera Probe); Sebifix® SF16
- B. **Products:** Base Shampoo and Conditioner (Table 1)
- C. **Software:** ImageJ (National Institutes of Health (NIH)); Excel Analysis ToolPak (Microsoft)

Table 1. Ingredient List (INCI Names) of Base Shampoo and Base Conditioner

Base Shampoo	Base Conditioner
Water	Water
Guar Hydroxypropyltrimonium Chloride	Polyquaternium-10
Sodium Methyl 2-Sulfolaurate	Glycerin
Cocamidopropyl Betaine	Cetrimonium Chloride
Lactobacillus Ferment	Behentrimonium Methosulfate
Lactobacillus	Cetearyl Alcohol
Coco Nucifera (Coconut) Fruit Extract	Butylene Glycol
	Hydrogenated Ethylhexyl Olivat
	Lactobacillus Ferment

Methods

Five female participants who were free of any skin known pathologies volunteered for this study. Each panelist had a baseline photo taken of their scalp prior to product application with DermaScope Camera Probe and again after one and two weeks of product application. The objective was set to 65x, and images were taken of the middle of the scalp. Additionally, hydration measurements were taken on the middle of the scalp and recorded throughout the study.

Participants were blindly treated with either the Base Shampoo and Base Conditioner or the test product containing 5.0% **AC AlfalfaBoost** in the Base Shampoo and Base Conditioner. Participants were instructed to keep their normal haircare and washing routines with the products they currently use apart from replacing their current shampoo and conditioner with the supplied test products. The bottles of shampoo and conditioner were weighed both before panelists received them and after the study was completed, to ensure proper washing periods occurred. Panelists were instructed not to wash their hair with their designated products, or apply dry shampoo, 24 hours before their final photographs and measurements were taken.

Sebufix® SF16 foils were used to measure the sebum content on participant's scalp. The Sebufix® SF16 foils absorb sebum present on the skin's surface and display spots in different sizes representative of the sebum content. Baseline sebum measurements were taken on day one of the study and after one week of product application on the middle of the scalp. Final sebum measurements were recorded after two weeks of product application.

Images of Sebufix® SF16 foils were taken after the participant's measurements were completed for baseline, week one, and week two of product application. The images were then analyzed in ImageJ analysis software (NIH) to analyze the particles that were present on the foils representing the sebum spots from the scalp. The more particles that are present and analyzed by ImageJ, the more sebum content that was on the scalp.

An average of three consecutive sebum and hydration measurements per condition at each time point was recorded and expressed as area of sebum (Pixel²) and micro-Siemens (μS), respectively, for each volunteer. Data are displayed as averages from all volunteers and analyzed using t-tests with statistical significance accepted at $p \leq 0.05$. Percent change was calculated for each condition at every timepoint relative to Baseline values, using the following equation:

$$\text{Percent Change (\%)} = \frac{\text{Sebum Value}_{\text{Timepoint}} - \text{Sebum Value}_{\text{Baseline}}}{\text{Sebum Value}_{\text{Baseline}}} \times 100$$

Results

The data obtained for this study met criteria for a valid study as the Base Shampoo and Conditioner performed as expected. 5.0% AC AlfalfaBoost reduced sebum on the scalp after two weeks of application while also increasing scalp hydration.

Scalp Sebum Presence AC AlfalfaBoost

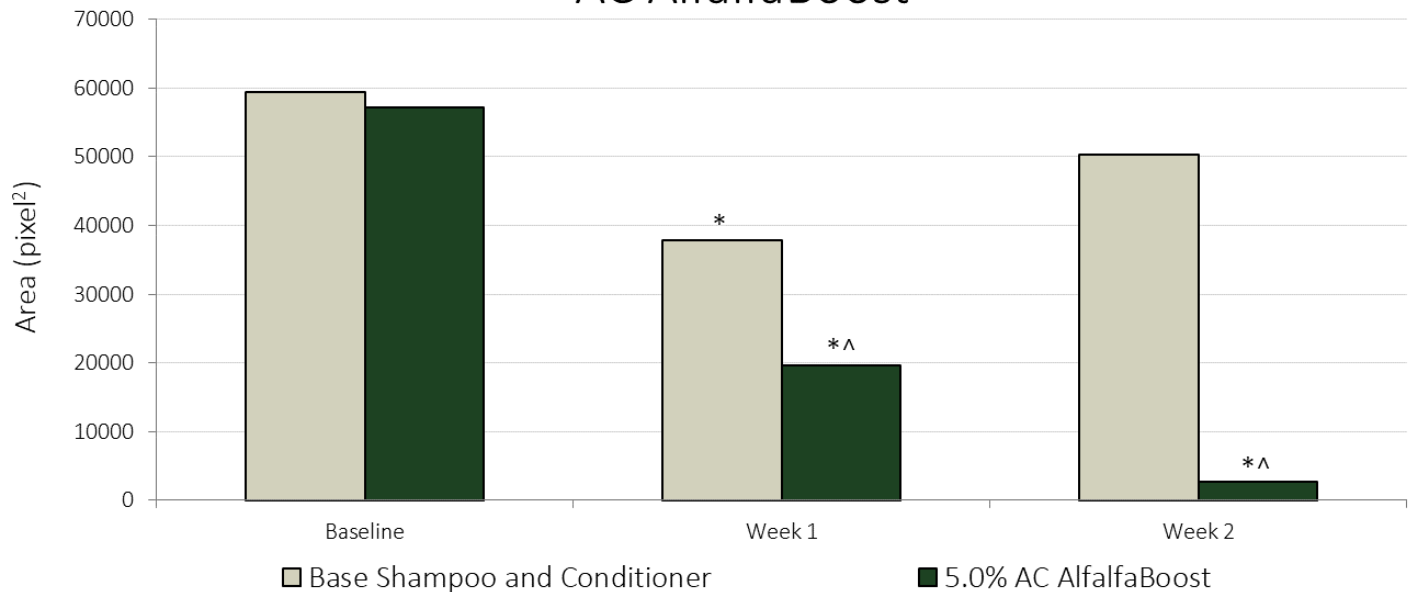


Figure 1. Scalp Sebum Overtime. * indicates significant ($p \leq 0.05$) compared to Baseline within the same condition. ^ indicates significance between conditions at given timepoint ($p \leq 0.05$).

Table 2. Results from T-test Analysis of Sebum Presence from Baseline to After 1 and 2 Weeks of Application. * indicates significance ($p \leq 0.05$) compared to Baseline values.

	Base Shampoo and Base Conditioner	5.0% AC AlfalfaBoost
After 1 Week of Application	0.006*	0.004*
After 2 Weeks of Application	0.158	0.001*

Table 3. Results from T-test Analysis of Sebum Presence After 1 and 2 Weeks of Application. ^ indicates significance ($p \leq 0.05$) between conditions within the same timepoint.

	<i>After 1 Week of Application:</i> Base Shampoo and Base Conditioner vs 5.0% AC AlfalfaBoost	<i>After 2 Weeks of Application:</i> Base Shampoo and Base Conditioner vs 5.0% AC AlfalfaBoost
P-value	0.038^	< 0.001^

Scalp Hydration AC AlfalfaBoost

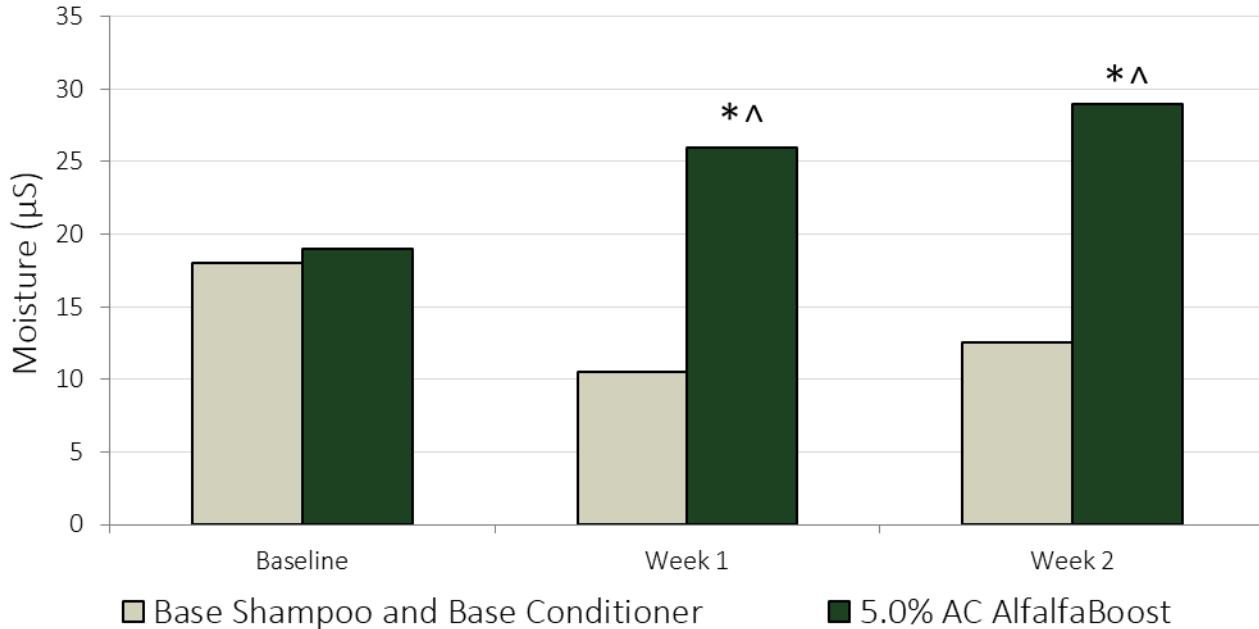


Figure 2. Scalp Hydration Overtime. * indicates significant ($p \leq 0.05$) compared to Baseline within the same condition. ^ indicates significance between conditions at given timepoint ($p \leq 0.05$).

Table 4. Results from T-test Analysis of Moisture Levels from Baseline to After 1 and 2 Weeks of Application. * indicates significance ($p \leq 0.05$) compared to Baseline values.

	Base Shampoo and Base Conditioner	5.0% AC AlfalfaBoost
After 1 Week of Application	0.074	0.017*
After 2 Weeks of Application	0.099	0.013*

Table 5. T-test Analysis of Moisture Levels After 1 and 2 Weeks of Application. ^ indicates significance ($p \leq 0.05$) compared to Base Shampoo and Base Conditioner within the same timepoint.

	<i>After 1 Week of Application:</i> Base Shampoo and Base Conditioner vs 5.0% AC AlfalfaBoost	<i>After 2 Weeks of Application:</i> Base Shampoo and Base Conditioner vs 5.0% AC AlfalfaBoost
P-value	0.005^	0.002^







Baseline		
After 1 Week of Application		
After 2 Weeks of Application		
	Base Shampoo and Base Conditioner	5.0% AC AlfalfaBoost

Image 1. Representative Scalp Images of Participants Overtime

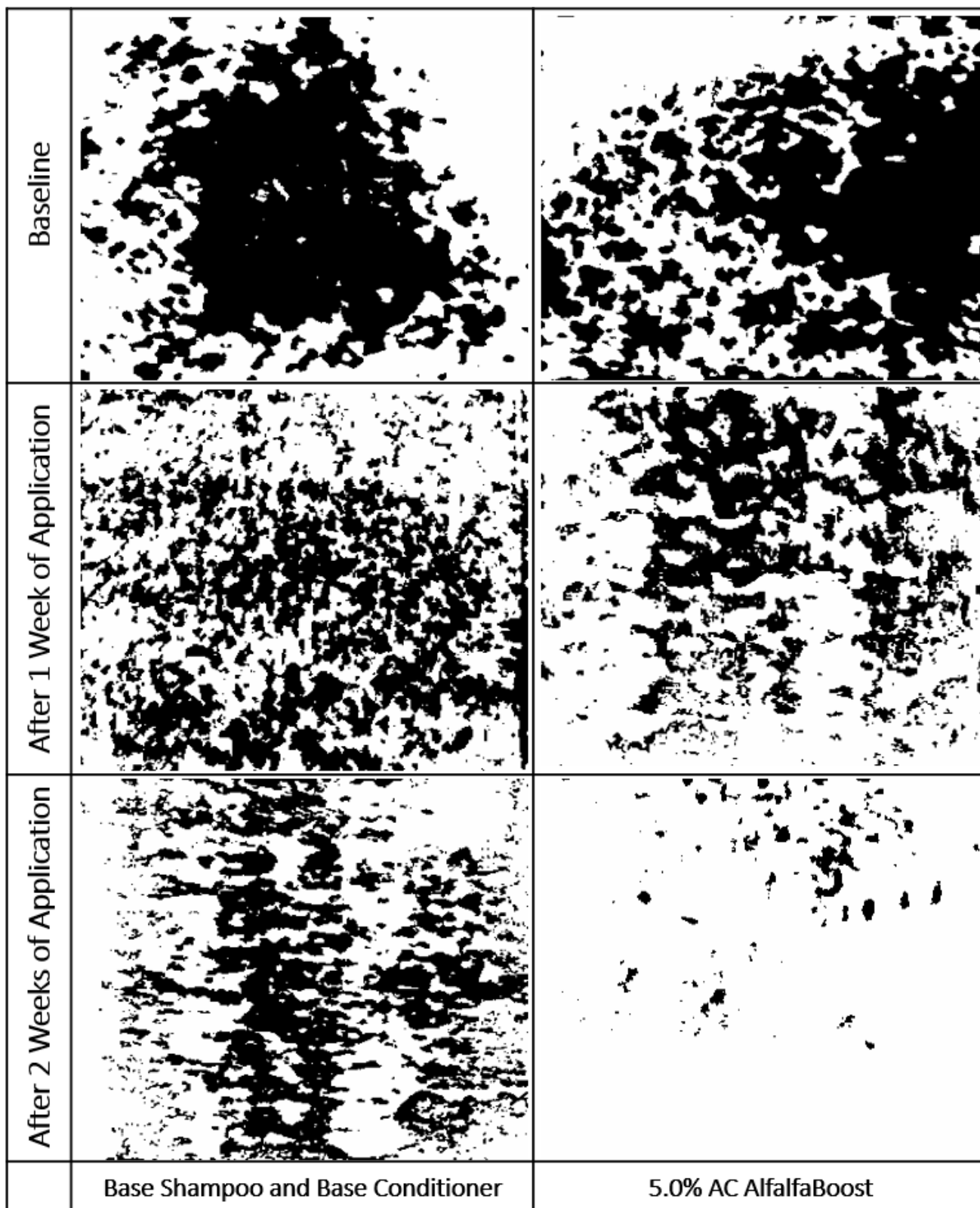


Image 2. Representative Images of Sebufix® SF16 Foils Indicating Sebum Present on Participant's Scalps Overtime. Dark spots represent sebum content. Skin with lower sebum content shows few small spots, whereas oily skin is displayed by a great number of large spots.

Discussion

This study was conducted to evaluate the sebum reducing properties of **AC AlfalfaBoost** on the scalp. When compared to baseline values, the Base Shampoo and Base Conditioner decreased scalp sebum content by 15% after two weeks of application (Figure 1, Table 2). Conversely, 5.0% **AC AlfalfaBoost** significantly reduced sebum levels on the scalp by 95% after two weeks of application, compared to baseline measurements (Figure 1, Table 2). These results indicate 5.0 % **AC AlfalfaBoost** effectively suppresses excess sebum levels present on the scalp after two weeks.

The Base Shampoo and Base Conditioner decreased scalp hydration levels by 31% after two weeks of application, respectively (Figure 2; Table 4). However, 5.0% **AC AlfalfaBoost** significantly increased hydration levels on the scalp by 53% after two weeks of application (Figure 2; Table 4). These results demonstrate **AC AlfalfaBoost** elicits hydration on the scalp with weekly application.

Similar results are shown when examining the collective effect between each condition for both sebum presence and hydration on the scalp. Applying 5.0% **AC AlfalfaBoost** significantly reduced scalp sebum content while also augmenting hydration after 1 and 2 weeks of application (Figures 1, 2; Tables 3, 5). These results indicate **AC AlfalfaBoost** effectively reduces excess sebum present on the scalp while also inducing hydration properties to prevent scalp irritation after application.

Visually, participants that applied 5.0% **AC AlfalfaBoost** experienced a decrease in scalp oiliness, while those who applied the base shampoo and conditioner saw an increase in scalp oiliness (Images 1, 2). These results demonstrate **AC AlfalfaBoost** elicits a reduction in scalp sebum presence with repeated applications.

The present study indicates **AC AlfalfaBoost**, when utilized at the recommended use-levels, alleviates the undesirable results of scalp sebum overproduction. Additionally, **AC AlfalfaBoost** elicits hydrating properties on the scalp, preventing dryness and irritation, while simultaneously providing sebum reducing benefits. Collectively, **AC AlfalfaBoost** suppresses sebum, while mitigating the shiny and greasy appearance from an oily scalp.