Acute Blue Light Microbiome Study

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Tradename: AC LumiVitis

Code: 21032

CAS #: 8013-01-2 & 85594-37-2 (or) 84929-27-1 & 68333-16-4 (or) 1686112-36-6 (or) 9015-54-7

Test Request Form #: 13666

Lot #: 9418748

Sponsor: *Active Concepts, LLC; 107 Technology Drive Lincolnton, NC 28092*
Study Director: *Daniel Shill*
Principal Investigator: *Kayla Goodson & Monica Beltran*

Test Performed:
Acute Blue Light Microbiome Study

Introduction

Skin appearance and overall complexion are influenced not only by light reflection and pigmentation, but also by the balance of the skin's microbiota. The dermal microbiome plays a critical role in maintaining barrier integrity and supporting cutaneous homeostasis. The T-zone area of the face is characterized by higher sebaceous activity, making it particularly susceptible to microbial fluctuations and visible skin concerns such as redness, breakouts, and uneven tone. Among the most prominent bacterial species residing on the skin are *Staphylococcus epidermidis* and *Staphylococcus aureus*. *S. epidermidis* is generally considered a commensal organism that contributes to skin barrier support and immune regulation. In contrast, *S. aureus* is a pathogen associated with inflammation, barrier disruption, and exacerbation of various dermatological conditions when present in elevated levels. Environmental stressors, including blue light exposure, may influence the skin microenvironment, potentially impacting microbial composition and overall skin balance.

Accordingly, an Acute Blue Light Microbiome Study was conducted to evaluate the presence of *Staphylococcus epidermidis* and *Staphylococcus aureus* on the T-zone following topical application of 2.0% **AC LumiVitis** and controlled blue light exposure to assess shifts in dermal microbiome balance.

Study Principle

Blank swabs are taken from the T-zone of each participant's face at baseline, prior to any product application. Next, test materials are applied to the skin test site once and participants undergo a controlled exposure of blue light for 15 minutes. Subsequent swabs are taken immediately and 45 minutes after blue light exposure. Estimated plate coverage of each bacterium was recorded at each timepoint.

Materials

A. **Materials:** Sterile Cotton-Tipped Applicators; 15mL Falcon Polypropylene Conical Tubes; Mannitol-Salt Agar – Differential Media; 100 x 15 MM Petri Dishes
B. **Products**: Base Lotion (Equate™ Beauty Oil-Free Facial Moisturizer)
C. **Software:** Excel Analysis ToolPak (Microsoft)

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Methods

10 volunteers between the ages of 24 and 46, who were known to be free of any skin pathologies with Fitzpatrick skin types I to III, participated in this study (Table 1).

Table 1. The Fitzpatrick Classification of Skin Types Chart[1]

Fitzpatrick Skin Type Descriptions*	
Skin Type	**Description**
I	Always burns, never tans
II	Burns easily, tans minimally
III	Burns moderately, tans to light brown
IV	Burns minimally, tans to moderate brown
V	Rarely burns, tans to dark
VI	Never burns, least sensitive to changes
*Adapted from The Surgeon General's Call to Action to Prevent Skin Cancer	

The T-zone area of each participant's face was designated as the test site for this study. Half of the participants applied the Base Lotion whereas the other half of the participants applied 2.0% **AC LumiVitis**, treatments described below (Table 2). Prior to test material application, baseline microbiological swabs were collected from the test site. After baseline collection, participants applied 0.2 g of the test material to the test site. The treated area was then exposed to 15 minutes of controlled blue light. Subsequent microbiological swabs were collected immediately and 45 minutes after blue light exposure. Each swab was inoculated onto a Mannitol Salt Agar plate (Table 3). The plates were incubated at 37°C for 24-48 hours, photographed, and bacterial growth was visually assessed. Bacterial plate coverage was estimated at each timepoint.

Table 2. Descriptions of the Conditions and Treatments for each Skin Test Site

Skin Test Site	Condition	Treatment / Test Article Application Description
1	Base Lotion Control	Base Lotion
2	2.0% **AC LumiVitis**	2.0% **AC LumiVitis** in Base Lotion

Table 3. Interpretation of Mannitol Salt Agar Plate

Organisms	Results
Staphylococcus aureus	Yellow colonies with yellow zones
Staphylococci other than S. aureus (e.g. *Staphylococcus epidermidis*)	Colorless or Red colonies with red zones
Streptococci	No growth or trace growth
Micrococci	Large white to orange
Gram-negative bacteria	No growth to trace growth

An average of estimated bacterial plate coverage per condition at each timepoint was recorded. Data are displayed as averages from all volunteers and analyzed using t-tests with statistical significance accepted at $p \leq 0.05$.

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Results

The data obtained met criteria for a valid study as the Base Lotion performed as anticipated. Application of 2.0% **AC LumiVitis** elicited acute growth of *S. epidermidis* and prevented growth in *S. aureus* throughout the study.

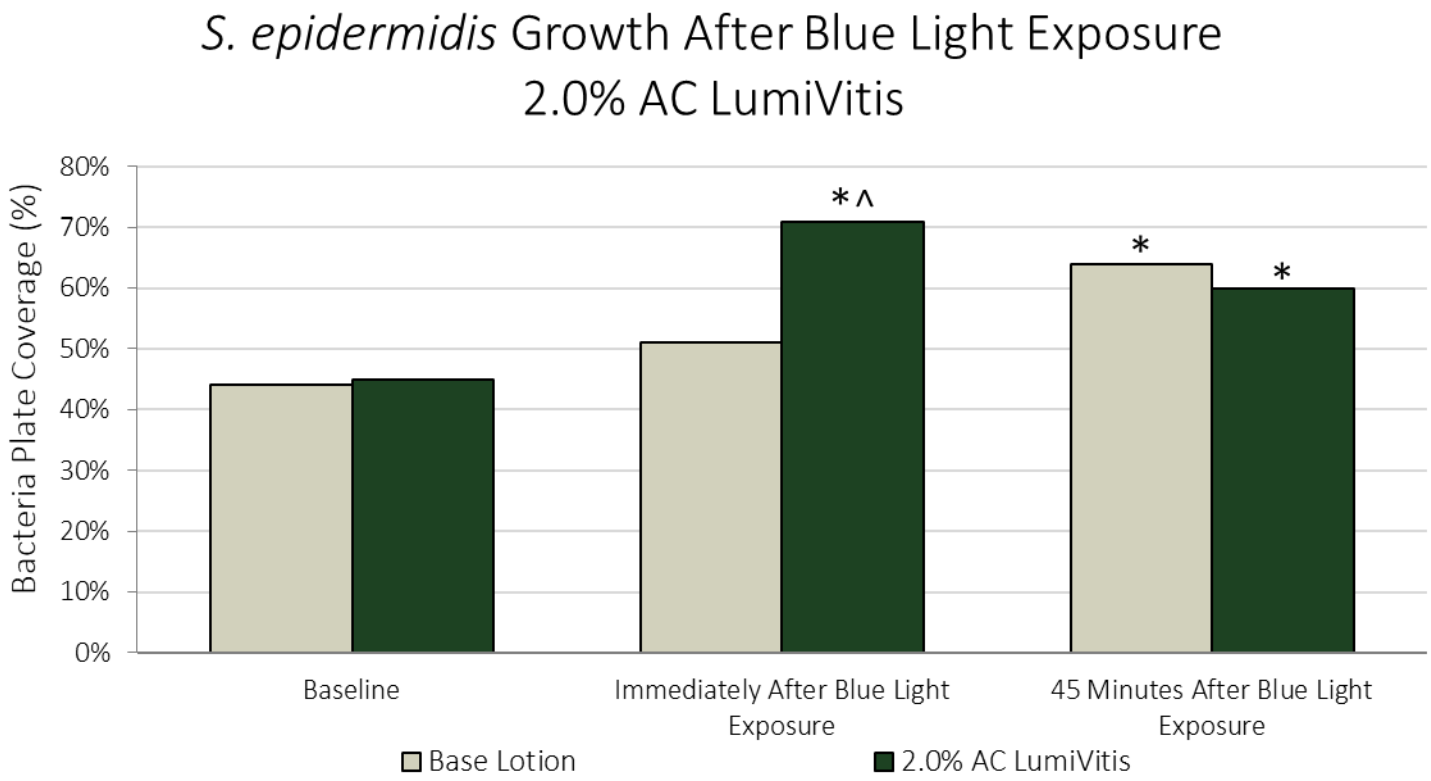

Figure 1. *S. epidermidis* Plate Coverage Overtime. * indicates significance ($p \leq 0.05$) compared to Baseline values. ^ indicates significance ($p \leq 0.05$) compared to Base Lotion within the same timepoint.

Table 4. P-values from t-test Analyses of *S. epidermidis* Plate Coverage from Baseline to Immediately After and 45 Minutes After Blue Light Exposure. * indicates significance ($p \leq 0.05$) compared to Baseline values.

	Base Lotion	2.0% **AC LumiVitis**
Immediately After Blue Light Exposure	0.085	< 0.001*
45 Minutes After Blue Light Exposure	0.035*	0.042*

Table 5. T-test Analysis of *S. epidermidis* Plate Coverage Immediately After and 45 Minutes After Blue Light Exposure. ^ indicates significance ($p \leq 0.05$) compared to Base Lotion within the same timepoint.

	Immediately After Blue Light Exposure: Base Lotion vs 2.0% **AC LumiVitis**	45 Minutes After Blue Light Exposure: Base Lotion vs 2.0% **AC LumiVitis**
P-value	< 0.001^	0.094

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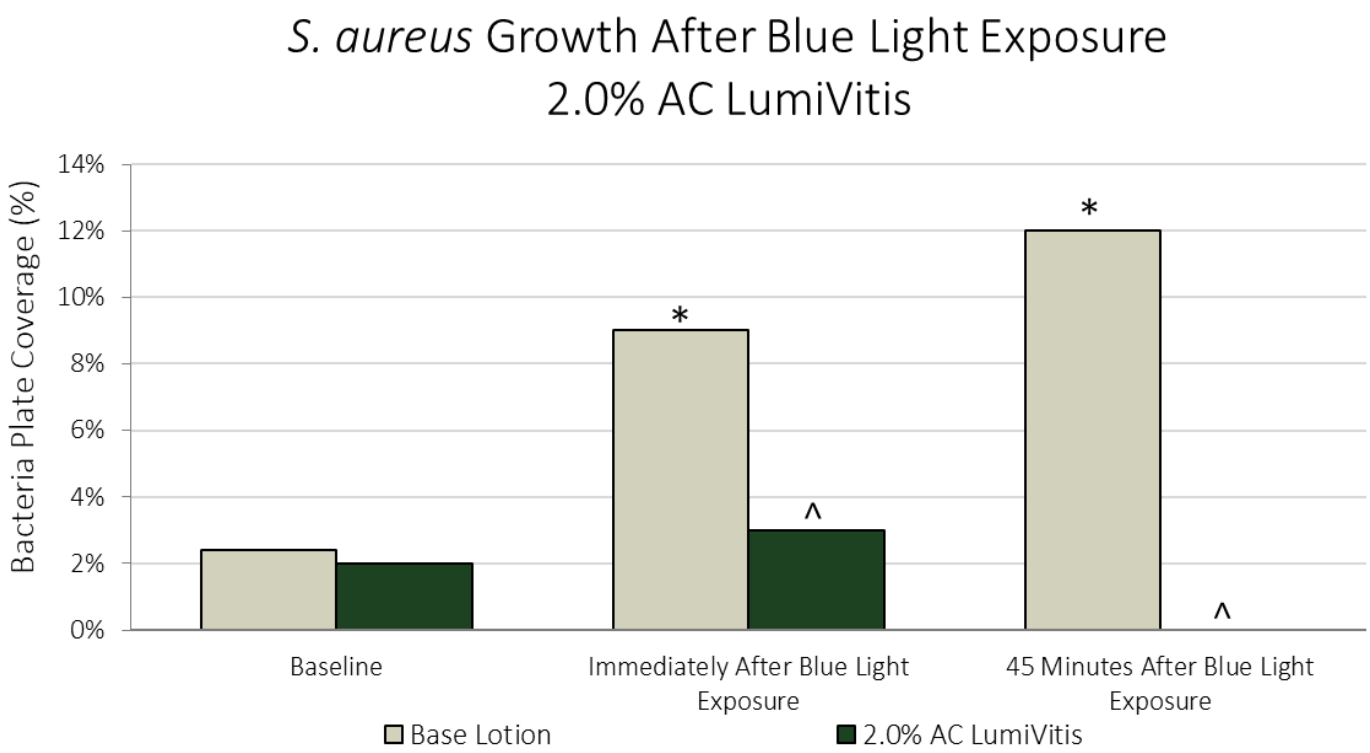

Figure 2. *S. aureus* Plate Coverage Overtime. * indicates significance ($p \leq 0.05$) compared to Baseline values. ^ indicates significance ($p \leq 0.05$) compared to Base Lotion within the same timepoint.

Table 6. P-values from t-test Analyses of *S. aureus* Plate Coverage from Baseline to Immediately After and 45 minutes After Blue Light Exposure. * indicates significance ($p \leq 0.05$) compared to Baseline values.

	Base Lotion	2.0% **AC LumiVitis**
Immediately After Blue Light Exposure	0.041*	0.098
45 Minutes After Blue Light Exposure	0.021*	0.100

Table 7. T-test Analysis of *S. aureus* Plate Coverage Immediately After and 45 Minutes After Blue Light Exposure. ^ indicates significance ($p \leq 0.05$) compared to Base Lotion within the same timepoint.

	Immediately After Blue Light Exposure: Base Lotion vs 2.0% **AC LumiVitis**	**45 Minutes After Blue Light Exposure:** Base Lotion vs 2.0% **AC LumiVitis**
P-value	< 0.001^	< 0.001^

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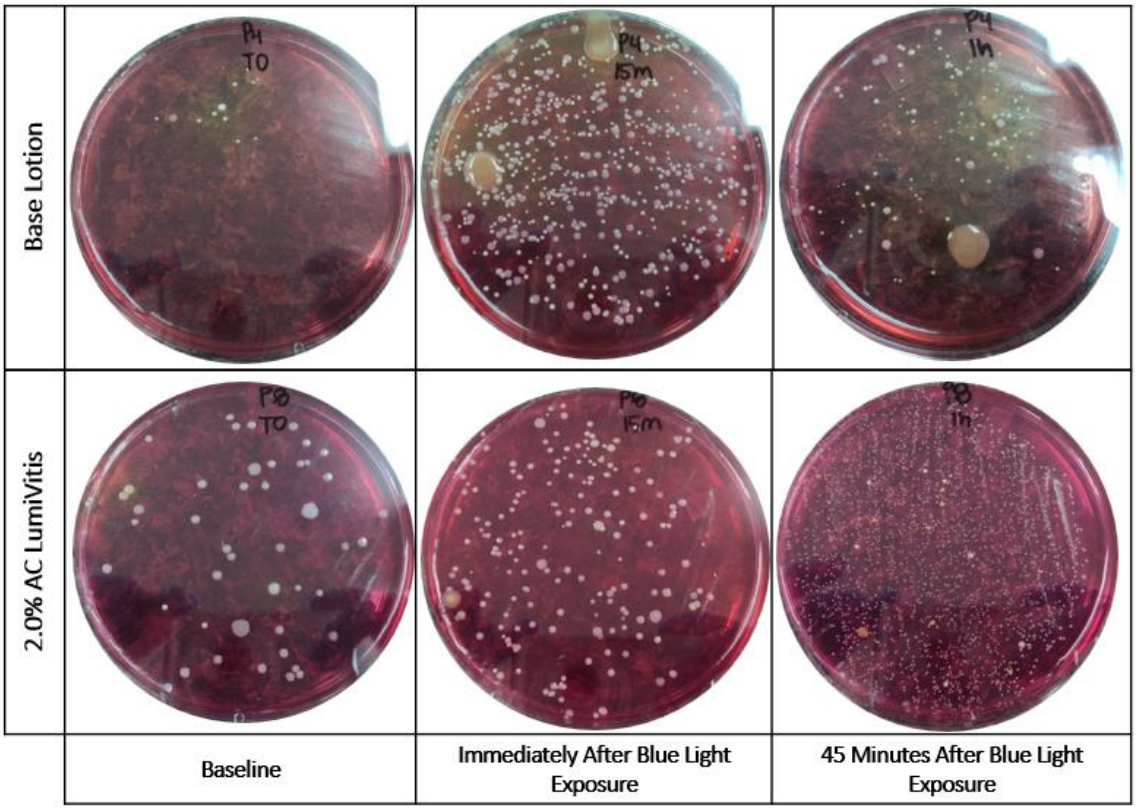

Image 1. Plate Photos demonstrating the presence of *S. epidermidis* and *S. aureus* coverage throughout the study. White, or colorless, dots represent *S. epidermidis* bacteria whereas yellow dots represent *S. aureus* bacteria.

Discussion

The ability of **AC LumiVitis** to acutely promote growth of *S. epidermidis* and inhibit *S. aureus* on the T-zone following blue light exposure was evaluated throughout the study. As shown in Figure 1, the Base Lotion did not significantly alter *S. epidermidis* presence immediately after blue light exposure, although a slight increase was observed at 45 minutes after blue light exposure, indicating only a marginal effect on *S. epidermidis* growth (Table 4). Conversely, 2.0% **AC LumiVitis** significantly enhanced the resilience of beneficial S. epidermidis immediately after blue light exposure and 45 minutes after exposure (Figure 1; Table 4). Plate coverage reached 71% immediately after exposure and 60% after 45 minutes, compared to 45% at baseline, demonstrating rapid reinforcement of beneficial microbiome presence (Figure 1; Image 1). Furthermore, 2.0% **AC LumiVitis** demonstrated significantly higher levels of S. epidermidis than the Base Lotion immediately after blue light exposure, with elevated levels maintained relative to the Base Lotion 45 minutes after exposure (Figure 1; Table 5; Image 1). These findings demonstrate that a single application of 2.0% **AC LumiVitis** helps strengthen microbiome resilience on the T-zone following blue light exposure.

Furthermore, the Base Lotion significantly increased *S. aureus* presence immediately after blue light exposure and 45 minutes after blue light exposure, indicating that the Base Lotion does not inhibit pathogenic bacterial growth following blue light exposure (Table 6). In contrast, 2.0% **AC LumiVitis** significantly reduced *S. aureus* growth immediately after blue light exposure and 45 minutes after blue light exposure compared to the Base Lotion (Figure 2; Tables 6, 7). Plate coverage measured 3% immediately after exposure and 0% by 45 minutes after exposure, compared to 2% at baseline, demonstrating a significant and rapid reduction in pathogenic bacterial presence (Figure 2; Image 1). Collectively, these findings indicate that a single application of 2.0% **AC LumiVitis** acutely inhibits *S. aureus* growth on the T-zone following blue light exposure.

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Taken together, these results indicate that **AC LumiVitis** acutely promotes the growth of *S. epidermidis* while inhibiting *S. aureus* on the T-zone following blue light exposure when incorporated into personal care applications at recommended use levels. Collectively, **AC LumiVitis** supports an increase in beneficial skin microbiota after blue light exposure, while simultaneously limiting pathogenic bacterial growth and maintaining skin barrier integrity.

References

1. Sharma AN, Patel BC. Laser Fitzpatrick Skin Type Recommendations. [Updated 2022 Mar 9]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK557626/