EEG Brainwave Study

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Tradename: AC WonderShroom

Code: 21029

CAS #: 84650-60-2 & 999999-99-4 (or) 68917-13-5 & 999999-99-4 (or) 68917-13-5 & N/A (or) 9057-02-7

Test Request Form #: 11681

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

Test Performed:
EEG (electroencephalography) Brainwave Study

Introduction

The physical experience of applying cosmetics is multifaceted and influences how consumers perceive products, demonstrating the importance of quantifying the complex effects of product application. Cosmetic products are designed to provide the traditional physical beauty attributes and benefits in addition to various sensory effects and an overall feeling of well-being. The physiological and psychological effects of cosmetics are inextricably linked given the physical act of applying a product 1) elicits positive emotions as it is perceived to improve physical appearance and 2) enhances relaxation similar to a body massage. Considering the physiological and psychological implications of product application are interdependent, enhancing the emotional response to cosmetic products can augment the consumer experience.

Accordingly, an EEG Brainwave Study was conducted to evaluate the immediate active thinking properties of **AC WonderShroom** application. Alpha GPC and Caffeine were also tested as comparative products.

Study Principle

A headband is placed on the forehead of participants and brainwaves are monitored as products are applied to the skin. The brainwaves associated with relaxation and calmness are isolated and analyzed to provide insight into the psychological state during product application.

Materials

A. **Equipment:** Muse 2 Headband and Application (IntraXon, Toronto, ON, Canada); Mind Monitor Application
B. **Products**: Base Lotion (Cetaphil® Moisturizing Cream for All Skin Types)
C. **Software:** Excel Analysis ToolPak (Microsoft)

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Methods

20 volunteers between the ages of 24 and 50, who were known to be free of any skin pathologies with Fitzpatrick skin types I to IV, 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	

Prior to initiating the study protocol, participants were seated in a quiet room for 10 minutes with the Muse 2 Headband on to obtain Baseline brainwave activity. Four randomly assigned test sites were identified on the volar forearm of participants and the order of applying conditions was randomized for each participant. Following stable Baseline measurements, the principal investigator physically applied 0.2 g of one condition to the respective test site for 30 seconds. After applying the first condition, brainwaves were monitored for 60 seconds without physical contact from the principal investigator. Once stable recordings were achieved, the principal investigator applied 0.2 g of the second condition to the respective test site for 30 seconds, this process continued until all test articles were applied. The skin test site conditions and treatments are described below (Table 2). The Base Lotion utilized in this study was Cetaphil® Moisturizing Cream for All Skin Types.

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	Base Lotion
2	3.0% Alpha GPC	3.0% Alpha GPC in Base Lotion
3	3.0% Caffeine	3.0% Caffeine in Base Lotion
4	2.0% **AC WonderShroom**	2.0% **AC WonderShroom** in Base Lotion

The Muse 2 Headband smart device has five EEG Brain Sensors detecting Gamma, Beta, Alpha, Theta, and Delta brainwave activity which indicate different psychological states (Table 3). The Muse 2 Application records these brainwaves and provides feedback regarding sensor placement and connectivity. Brainwave data was exported from the Muse 2 Application and uploaded to the Mind Monitor Application for individual brainwave analysis.

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Table 3. Brainwave Activity Detected by the Muse 2 Headband

Brainwave	Psychological State
Gamma	Heightened perception, problem solving tasks
Beta	Awake, thinking, alert consciousness
Alpha	Physically and mentally relaxed
Theta	Light Sleep, dreams
Delta	Deep sleep, loss of bodily awareness

The absolute Beta brainwaves during the 30 second application period were utilized for analysis. An increase in Beta brainwave activity indicates an increase in active thinking properties during application. Data are displayed as averages from all volunteers and analyzed using t-tests with statistical significance accepted at $p \leq 0.05$. Data is displayed relative to Baseline Beta brainwave activity according to the following equation:

$$Brainwave\ Activity = \frac{Brainwave\ Activity_{Condition}}{Brainwave\ Activity_{Baseline}}$$

Percent change in absolute Beta brainwave activity calculated for each test site relative to Baseline values, using the following equation:

$$Percent\ Change\ (\%) = \frac{Brainwave\ Activity_{Condition} - Brainwave\ Activity_{Baseline}}{Brainwave\ Activity_{Baseline}} \times 100$$

Results

The data obtained from this study met criteria for a valid study as the Base Lotion performed as anticipated. Application of 2.0% **AC WonderShroom** demonstrated effective immediate relaxation properties by significantly increasing Beta brainwave activity compared to Baseline, Base Lotion,3.0% Alpha GPC, and 3.0% Caffeine.

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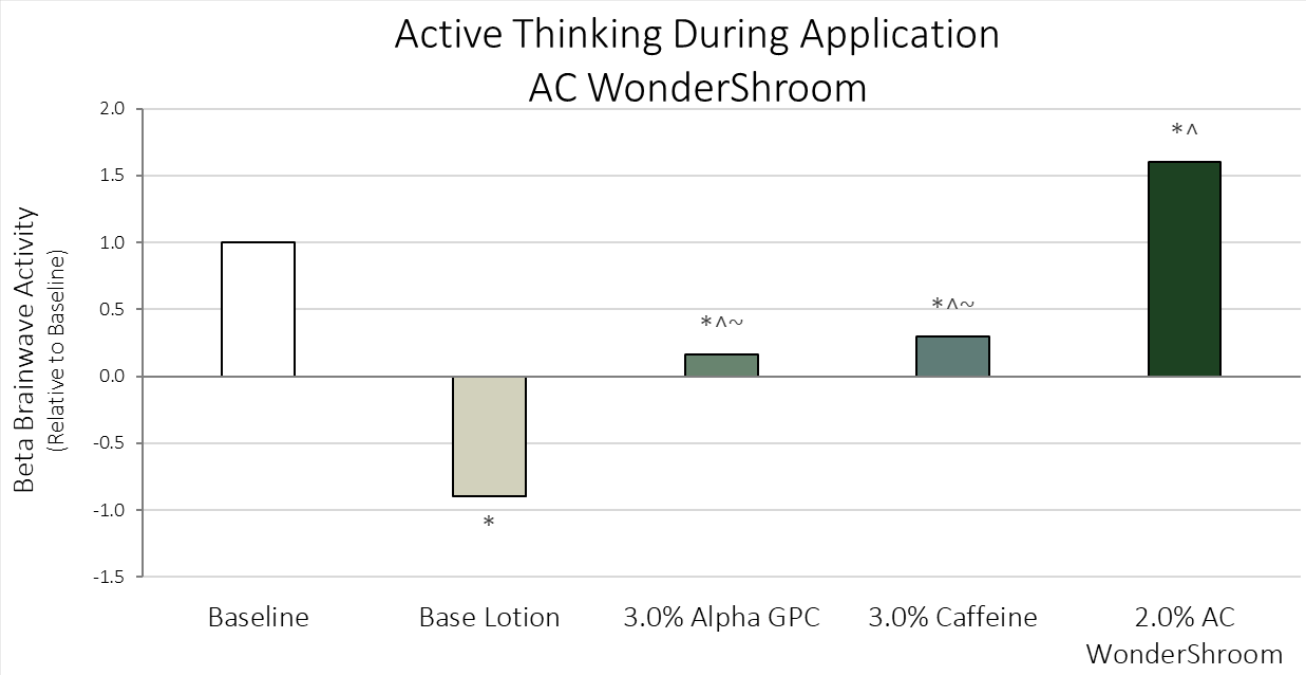

Figure 1. Beta Brainwave Activity During Product Application Relative to Baseline. * indicates significance ($p \leq 0.05$) compared to Baseline. ^ indicates significance ($p \leq 0.05$) compared to Base Lotion. ~ indicates significance ($p \leq 0.05$) compared to **AC WonderShroom**.

Table 4. Results from T-test Analyses of Beta Brainwave Activity During Application compared to Baseline. * indicates significance ($p \leq 0.05$) compared to Baseline.

	Baseline vs Base Lotion	Baseline vs 3.0% Alpha GPC	Baseline vs 3.0% Caffeine	Baseline vs 2.0% **AC WonderShroom**
P-value	0.164	0.040*	0.041*	0.035*

Table 5. Results from T-test Analyses of Beta Brainwave Activity During Application compared to Base Lotion. ^ indicates significance ($p \leq 0.05$) compared to Base Lotion.

	Base Lotion vs 3.0% Alpha GPC	Base Lotion vs 3.0% Caffeine	Base Lotion vs 2.0% **AC WonderShroom**
P-value	0.017^	0.030^	0.001^

Discussion

The ability of **AC WonderShroom** to elicit a relaxed state upon application was assessed via Beta brainwave activity during 30 seconds of application. As shown in Figure 1, Beta brainwave activity was reduced by 0.9% during Base Lotion application, indicating the Base Lotion does not elicit active thinking properties upon application (Figure 1; Table 4). Conversely, 3.0% Alpha GPC and 3.0% Caffeine significantly increase Beta brainwave activity by 0.15% and 0.30%, compared to baseline (Figure 1; Table 4). Moreover, 2.0% **AC WonderShroom** significantly increased Beta brainwave activity by 1.6% during the 30-second application compared to baseline brainwave activity (Figure 1; Table 4). Furthermore, application of 2.0% **AC WonderShroom** elicited significantly greater Beta brainwave activity compared to 3.0% Alpha GPC and 3.0% Caffeine (Figure 1; Table 5). These results demonstrate **AC WonderShroom** has effective immediate and short-term active thinking properties during application.

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In conclusion, these results indicate AC WonderShroom increases Beta brainwave immediately during application when added to personal care products at recommended use levels. Collectively, AC WonderShroom enhances the psychological response when applying a cosmetic product, by increasing active thinking properties, which can augment the consumer experience.

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/