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Research Article

Impact of a Topical Cosmetic Product Intended to Promote the Health and Appearance of Women's Hair

Jacquelyn Pence, Allyson Davis, Anna Fracchia, Amr Mohamed and Richard J Bloomer*

Center for Nutraceutical and Dietary Supplement Research, College of Health Sciences, University of Memphis, Memphis, USA

Abstract

Background: Multiple botanicals are touted as health enhancing for women's hair, but few studies have investigated products marketed to improve hair health. The purpose of this study was to evaluate a topical and botanical cosmetic product to enhance the health and beauty of women's hair and related outcomes of well-being in a sample of healthy women with current dissatisfaction with the health of their thinning hair.

Methods: Fourteen subjects with self-reported limp or visibly thin hair were provided a topical hair product using an open-label design and asked to apply this daily for four weeks. Subjects were female, aged 35-70 years. On the days of testing (Days 1, 15, and 30), subjects reported to the lab in the morning hours, having washed their hair 24-36 hours prior. Subjects completed a brief questionnaire regarding their hair quality, as well as their overall well-being. They had digital photos taken of their hair by trained investigators, for analysis of hair count and hair density using the "MyHairCounts" app. Finally, they completed a 60-second hair comb test to determine hair loss. At the conclusion of the study, subjects completed a subjective assessment of the product.

Results: Subjects perceived a significant change in hair thickness, shininess, strength, and speed of growth after 15 and 30 days of applying the botanical cosmetic product to their scalp (p<0.05). They also reported having more satisfaction with their hair after 30 days of use. No changes to well-being measures or hair density/count were observed. Less hair loss was measured following the 60-second hair comb test after 30 days of use compared to baseline (p<0.05).

Conclusion: Daily application of the topical botanical product over four weeks resulted in significant differences in hair quality and hair loss in otherwise healthy women with hair quality dissatisfaction.

Keywords: Alopecia; Botanical cosmetic; Hair loss; Natural products

*Corresponding author: Richard J Bloomer, Center for Nutraceutical and Dietary Supplement Research, College of Health Sciences, University of Memphis, Memphis, USA, Tel: +1 9016785638; E-mail: rbloomer@memphis.edu

Background

Hair loss can be a major source of psychological distress, impacting individual's quality of life [1,2]. While there are many different types of hair loss, the most common in women is female pattern hair loss, also referred to as androgenetic alopecia, which affects 20% of adult women in the United States [2,3].

The global market for hair loss treatments is a multi-billion dollar industry [4]. In 2023, the alopecia market was $8.77 billion, with the interest in female alopecia treatments in particular projected to increase over the next few years ("Alopecia Market Size, Share & Growth Analysis Report, 2030," n.d.). Women spend significant amounts of money annually on products and treatments specifically focused on hair growth including injections, transplants, and stem cells [3]. In a survey of 100 individuals experiencing chronic alopecia, two-thirds reported buying at least one over the counter product for hair growth [5]. Only two drugs have received FDA approval for treating androgenetic alopecia, Minoxidil and Finasteride, both of which have known side effects, motivating many individuals to seek out natural products [6]. Additionally, Finasteride does not work for all female pattern hair loss [7].

Aside from potential concern for adverse effects, individuals seek out complementary and alternative medicine options such as natural hair products for a variety of reasons, including availability, affordability, and their ability to be used in combination for a more robust biochemical action [8]. While some herbal/botanical components can help maintain the anagen (growth) phase in hair, others may be used to inhibit apoptosis in the catagen (regression) phase [9]. Various herbs and botanicals have been identified as having properties that are beneficial to hair health and combatting hair loss [10,11]. Although many herbal, botanical, and natural product lack the scientific evidence backed by human clinical trials [8], there have been numerous oral and topical natural products clinically studied that have been shown to be efficacious for alopecia [8,12,13].

This present pilot study used an open-label design and enrolled 14 women with hair dissatisfaction to investigate the impact of a daily topical botanical product applied to women's hair on perceived hair quality and overall well-being over a 30-day period. Hair density was measured via photo-analyses of scalp images with the mobile application, MyHairCounts, and hair loss was assessed with the 60-second hair comb test. We hypothesized that hair quality would be improved over time, based on subjective/perceived and objective measures.

Methods

Subjects

Fourteen women between 35 and 70 years of age who were not lactating, pregnant, or trying to become pregnant and who had regular/stable menstrual cycles or who were post-menopausal were recruited to participate. All subjects provided informed consent prior to completing the open label, pilot study. Subjects were non-smokers with self-reported limp or visibly thin hair and experiencing mild to moderate hair thinning. They did not have any known health conditions that would affect their hair health. Individuals with a clinically significant medical history (including alopecia), baldness, or significant loss of hair were not included. In addition, individuals must not have used medications or supplements for hair loss during the three months prior to the study and had no history of allergic/sensitive reactions to test product components. All procedures were approved by the University of Memphis Institutional Review Board for Human Subjects Research (protocol PRO-FY2024-1), and the study was registered through clinicaltrials.gov (NCT06060834).

Study material

The patent-pending product formulated by Mirparm LLC (Woodland, CA) contains 11 ingredients (cayenne pepper, coconut water, kelp, lemon juice, Oxynex LM [Merck KGaA], potassium sorbate, red palm oil, rose water, saw palmetto, and vitamin C) that have a well-established history of use in various cosmetic and personal care products, with some having established benefits for supporting hair health.

The product was applied daily using a supplied eye dropper. Subjects were instructed to apply 3 droppers once daily after shampooing. If the subject was not shampooing, subjects were instructed to apply to wet hair and then rinse. The product was to be applied directly to scalp (middle and each side) and the product was then massaged into the scalp for 30 seconds prior to rinsing out. The product was refrigerated prior to distribution to the subjects. Subjects were informed to store the product at room temperature.

Study procedures

During the initial visit to the laboratory, subjects completed the informed consent form, health history and medication/dietary supplement history. The health history and medication/dietary supplement questionnaire were reviewed by the investigators for any contraindicators. Subjects were escorted to a private restroom within the lab where they self-collected a urine sample for a urine pregnancy test to be completed (assuming pre-menopausal). Subjects' heart rate and blood pressure, height, weight, waist, and hip circumference were measured and are reported in table 1.

Participants reported to the lab on three days (day 1, day 15, day 30) having shampooed for the last time between 24 and 36 hours prior to each test visit. Testing was conducted in the morning hours and at the same time of day for each subject. Upon arrival, subjects were escorted to a private restroom within the lab where they again self-collected a urine sample to perform a pregnancy test. Blood pressure and heart rate were measured after resting for 10 minutes, and then subjects completed a brief questionnaire pertaining to their hair quality and overall well-being. They also had photos taken of their hair (top of head) by trained investigators for analysis using the "MyHairCounts" app. The app provides data specific to the following scalp variables: hair density (hairs per cm²), grayness, and dandruff. Finally, they completed the 60-second hair comb test in the laboratory using

Characteristics	Mean (SD)
Height (cm)	161.93 (5.37)
Weight (kg)	72.5 (13.23)
BMI (kg/m^2)	27.79 (5.66)
Waist (cm)	87.82 (13.68)
Hip (cm)	107.96 (10.74)
Waist/Hip	0.81 (0.07)
Systolic Blood Pressure (mm Hg)	117.64 (12.5)
Diastolic Blood Pressure (mm Hg)	76.57 (8.78)
Heart Rate (bpm)	71.29 (9.38)

Table 1: Baseline subject characteristics (N=14).

Note: Women had self-reported limp or visibly thin hair and experienced mild to moderate hair thinning, were not taking medications or supplements, and did not have health conditions that would affect hair health; individuals with clinically significant medical history (including alopecia), baldness or significant loss of hair were not included.

a Cleopatra 400 comb (Krest, Leominster, MA) over a pillowcase. Hairs were counted by investigators following completion of the test [14-16]. At the first visit, subjects were provided with the test product and instructions for application. At the final visit, subjects were asked to complete a product assessment questionnaire.

Data analysis

A total of 14 participants were included in the analysis. Variables were measured at baseline, second visit (day 15) and third visit (day 30). A repeated measures ANOVA was conducted to assess the changes of hair counts and hair density over time, and Bonferroni correction was used for multiple comparisons adjustments. Significance was set at $p<0.05$.

Results

Study population

A total of 14 women completed all aspects of the study. An additional participant provided informed consent and met inclusion criteria but was unable to participate due to scheduling conflicts. The participants had a mean age of 48.9 ± 8.9 years. Descriptive data on subject population is presented in table 1. No changes to blood pressure or heart rate were observed throughout the entire study period (results not shown).

Outcomes

Subject perceptions of hair characteristics and well-being: Responses specific to the perceived hair quality and well-being questionnaires at each visit are summarized in table 2. Subjects were more satisfied with their hair following 30 days of treatment. There was a significant difference between the three visits with $F_{(2,26)} = 8.356$ and $p = 0.002$. Pairwise comparisons found the only difference was found between the third visit and baseline visit ($p = 0.01$).

In addition to overall hair quality, there was a significant difference in subject's perceived hair thickness between the three visits with $F_{(2,26)} = 16.898$ and overall $p < 0.001$. By checking the pairwise comparisons, there was a significant difference between the first visit and second visit with $p = 0.007$ and between the first and third visit with $p < 0.001$, indicating subjects perceived their hair was thicker following treatment. Similarly, subjects perceived their hair was

Hair/Well-being variable	Visit 1	Visit 2	Visit 3	Partial eta squared	Significant
Hair Thickness	3.48 (1.55)	4.78 (1.58)	5.47 (1.59)	0.565	Yes
Hair Fullness	4.41 (1.64)	4.83 (1.63)	5.54 (1.79)	0.207	No
Hair Shininess	4.42 (1.96)	5.41 (1.43)	6.15 (1.51)	0.38	Yes
Hair Texture	5.61 (1.77)	5.82 (1.29)	6.27 (1.27)	0.088	No
Hair Strength	4.54 (1.71)	5.32 (1.32)	6.48 (1.41)	0.471	Yes
Overall Hair Appearance	4.82 (1.70)	5.58 (1.10)	6.24 (1.38)	0.29	No
Overall Hair Satisfaction	4.64 (1.77)	5.69 (1.31)	6.34 (1.66)	0.391	Yes
Compliments	4.21 (2.54)	4.27 (2.26)	4.72 (1.96)	0.05	No
Split ends	5.87 (2.82)	5.03 (2.74)	5.31 (2.82)	0.177	No
Ease of Styling	5.85 (2.01)	5.96 (1.68)	6.25 (1.72)	0.035	No
Speed of Growth	4.16 (2.05)	5.22 (1.55)	5.59 (1.69)	0.504	Yes
Confidence	6.43 (1.55)	6.45 (0.87)	6.72 (1.11)	0.044	No
Self-Conscious	4.61 (2.16)	4.44 (1.77)	4.65 (2.28)	0.006	No
Motivated	6.44 (1.65)	6.82 (1.09)	6.63 (1.38)	0.035	No
Attractive/Beautiful	5.59 (1.24)	5.48 (1.30)	5.61 (1.47)	0.009	No

Table 2: Self-reported hair quality and overall well-being.

Note: Hair responses for how the subject was currently feeling at each visit for the time, with 0 (extremely poor) to 10 (excellent) for Hair thickness, fullness, shininess, texture, strength, overall appearance, and satisfaction; 0 (never) to 10 (very often) for compliments, and split ends; 0 (very difficult) to 10 (very easy) for styling; and 0 (very slow) to 10 (very fast) on a continuous scale. Similarly, well-being responses for how the subject was currently feeling about each prompt from 0 (extremely poor) to 10 (excellent) using a continuous scale.

shinier after using the product for 15 and 30 days. There was a significant difference between the three visits with $F_{(2,26)} = 8.034$ and overall p = 0.002. Pairwise comparisons found there was a significant difference between the first and third visit with p = 0.02. Hair strength was also found to be significantly different between the three visits with $F_{(2,26)} = 11.563$ and p = 0.002. Significant differences were observed for pairwise comparisons between the first and third visit with p = 0.004 and the second and third visit with p = 0.01. Hair growth was also significantly different between the three visits with $F_{(2,26)} = 13.223$ and p < 0.001. There was a significant difference between the first and second visit with p = 0.005 and significant difference between the first and third visits with p = 0.003. No significant difference between the second and third visit was observed for hair thickness, shininess, strength, or speed of growth. No significant differences were detected for hair texture, fullness, appearance, split ends, ease of styling nor were there any differences reported in receiving more compliments or any of the well-being questions including confidence, self-consciousness, motivation, and perceived attractiveness (p>0.05).

Hair density and count: Hair density and counts as determined by the mobile application MyHairCounts (Houston, TX) are summarized in table 3. There was no significant difference in hair density or counts for any of the three individual measured sites (front, back, center), nor on average (p > 0.05).

Comb test: The average number of hairs lost by subjects at each visit while completing the 60-second comb test are summarized in table 4 and figure 1. A significant difference was found between the three visits with $F_{(2,26)} = 4.547$ with p = 0.02. More specifically, by checking the pairwise comparison, there was a significant difference between the first and third visit with p = 0.016, which means their hair loss in the first (baseline) visit was significantly higher than the third visit. No significant difference between the first and second, or between the second and third visits.

Source/ location of measurement	Visit 1	Visit 2	Visit 3	Overall partial eta squared	Significant difference?
Back count	43.07 (7.45)	41.21 (6.84)	41.71 (8.75)	0.029	No
Back density	155.86 (26.87)	149.21 (24.79)	151 (31.61)	0.028	No
Center count	38.79 (5.92)	42.43 (7.95)	43.86 (7.19)	0.184	No
Center Density	140.36 (21.425)	153.57 (28.825)	158.79 (26.012)	0.185	No
Front count	40.07 (7.31)	40.43 (7.92)	38.36 (9.63)	0.021	No
Front Density	144.93 (26.49)	146.50 (28.62)	138.93 (34.89)	0.021	No
Average count	40.64 (4.72)	41.36 (5.54)	41.31 (6.48)	0.009	No
Average Density	147.05 (17.06)	149.76 (20.03)	149.57 (23.44)	0.010	No

Table 3: Hair density and counts as determined via MyHairCounts [mean (SD)].

Characteristics	Visit 1	Visit 2	Visit 3	partial eta squared
Number of hairs	61.57 (68.91)	48.36 (64.14)	41.5 (56.03)	0.259

Table 4: Hairs counted following comb test [mean (SD)].

Subject perceptions of product: Overall, subjects found the product easy to use (7.0 +/- 1.7 out of 10) and enjoyed the smell (7.2 +/- 2.3 out of 10). The perception of product effectiveness varied among subjects (5.8 +/- 2.4) There were no adverse events/side effects reported with treatment. Results are detailed in table 5.
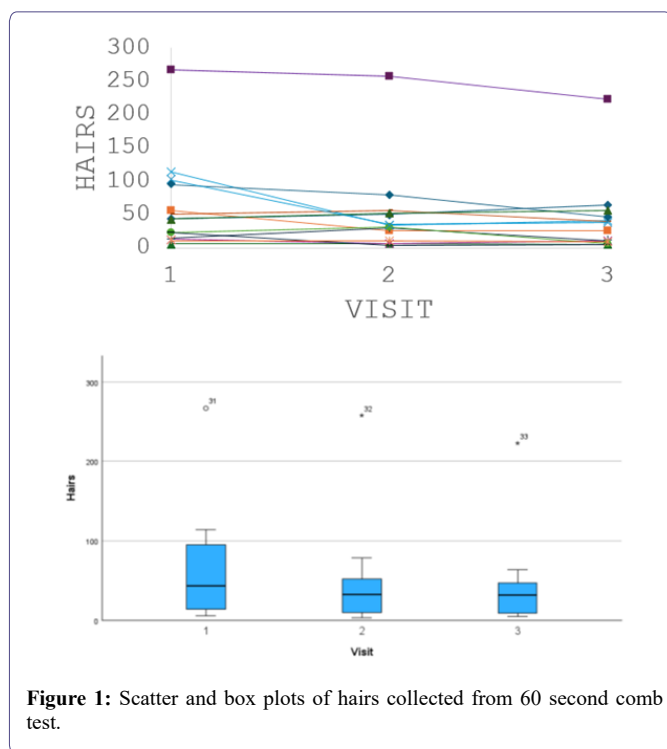
Figure 1: Scatter and box plots of hairs collected from 60 second comb test.

Characteristics	Mean (SD)	Median	Min	Max
Like the smell of product	7.18 (2.34)	7.9	1	9.5
Easy to apply/use	7.01 (1.70)	7.05	4.05	9.5
Product was effective	5.83 (2.38)	6.6	1	9.5

Table 5: Product assessment performed by 14 women after using the product for 30 days.

Note: Product assessment answers were assessed at the final visit by each subject with 0 (not at all) to 10 (very much) for each variable on a continuous scale.

Discussion

The purpose of this study was to determine the effect of a topical botanical cosmetic product on hair quality and health. Similar to other hair loss supplements, this test product uses multiple ingredients indicated to be favorable for thinning hair to facilitate a more robust response [7,17-19], including cayenne pepper, saw palmetto, and kelp. Cayenne pepper contains capsaicin which has previously been shown to induce the anagen phase of hair growth [10,19-21]. Similar to the drug Finasteride, saw palmetto works through the inhibition of 5α-reductase [12,18,22,]. In addition, seaweeds including kelp have many beneficial properties suitable for cosmetic uses [23,24]. Research has shown that kelp treatment can improve the tensile strength of hair and may help prevent hair damage [25] and, when taken orally in combination with other herbal compounds, improves hair growth in women [26].

Hair density determined through photo-analyses via the MyHair-Counts mobile application and a 60-second comb test were used as concrete, objective measures of the product's effect on hair health/loss. No changes in hair count or hair density were observed with use of the test product. Considering the phase lengths of the hair cycle, the length of this pilot study was likely not sufficient enough to capture these changes of hair loss [10].

Although we are unable to detect changes in hair density within the short study period, hair loss during the comb test was decreased following treatment, which could have been due to less hair breakage and/or hair loss. Additionally, subjective measures—specifically, subject's feelings towards their hair quality—were improved. Previous research has demonstrated that an individual's feelings about their hair impacts their self-esteem and overall well-being [2]. Application of the product for 30 days resulted in subjective improvements in hair thickness, hair shininess, hair strength, overall hair satisfaction, and speed of growth—all of which may have implications to overall self-esteem. A longer-term, placebo-controlled trial is needed to extend these findings.

In accordance with our hypothesis, using the topical product resulted in significant subjective improvements, in addition to a significant decrease in the number of hairs lost during comb tests after 30 days of treatment. These findings suggest a positive effect of treatment and provide rationale for further and longer-term investigation. As a pilot study, the number of subjects was low and the length of treatment short, which greatly limited our ability to detect more robust changes in hair quality measures. Previous hair loss research studies are typically 6 months or longer, although some benefits were observed at 2 and 3 month timepoints for multiple different herbal products [8,12]. Future studies should extend to longer timepoints (3-12 months) to determine whether this combination of botanicals can stimulate meaningful changes in hair density and decrease hair loss. Further, future studies should assess different hair types (vellum/terminal) and hair phases.

While results appear promising, there are limitations that need to be considered. First, the study included no placebo condition. Therefore, subjects may have reported improvements in the subjective assessments based on their expectations of an effect. For the comb test, values were indeed lower for this objective assessment. However, it is possible that other factors (e.g., hormonal changes across the menstrual cycle) may have contributed to the findings. Also, subjects were considered to be middle-aged on average. We do not know if these findings can be extrapolated to younger or older women and this needs to be evaluated in future research.

Conclusion

Subjects perceived a significant change in hair thickness, shininess, strength, and speed of growth after 15 and 30 days of applying the botanical cosmetic test product to their scalp in this pilot study. They also reported having more satisfaction with their hair after 30 days of use. No changes to well-being measures or hair density and count were noted. However, less hair loss was measured following a comb test performed in the laboratory after 30 days of use compared to baseline. A more in-depth investigation into potential benefits is warranted based on these preliminary findings.

Trial Registration: NCT06060834.

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