EFFICACY OF 0.1% TOPICAL FINASTERIDE SPRAY SOLUTION FOR MALE EYEBROW ENHANCEMENT: A RANDOMIZED, DOUBLE-BLIND, PLACEBO-CONTROLLED, SPLIT-FACE COMPARATIVE PILOT STUDY

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ARTICLE HISTORY
Received: 22 December 2025 **Revised:** 08 January 2026 **Accepted:** 21 January 2026

ABSTRACT
Topical finasteride has been successfully used for the treatment of androgenetic alopecia, offering localized efficacy with reduced systemic side effects. However, its application for eyebrow enhancement has not yet been investigated. This randomized, double-blind, placebo-controlled, split-face pilot study aimed to evaluate the efficacy and safety of a 0.1% topical finasteride spray solution for male eyebrow enhancement. Eight male participants with eyebrow hypotrichosis (GEBA grade I–II) applied finasteride to one eyebrow and placebo to the other twice daily for 12 weeks. The primary outcome, assessed by blinded dermatologists using standardized global photographic scores, demonstrated significantly greater improvement on the finasteride-treated side from week 4 onwards ($P < 0.01$). Secondary outcomes showed a statistically significant increase in eyebrow hair count in the finasteride group compared to placebo at week 12 (mean increase: +24.8 vs. +4.8 hairs; $P = 0.008$), while hair diameter changes were minimal and not significant. All participants expressed satisfaction with finasteride treatment, though the difference in satisfaction scores compared to placebo did not reach statistical significance. The intervention was well-tolerated with no systemic side effects or participant dropouts. Preliminary evidence from these results suggests that 0.1% topical finasteride spray may serve as a safe and non-invasive therapeutic option for male eyebrow enhancement, and these findings warrant further investigation in larger, adequately powered studies.

Keywords: Eyebrow Hypotrichosis, Male Eyebrow Enhancement, Topical Finasteride, Placebo, Pilot Study

CITATION INFORMATION: Chittipornsan,K., & Temnithikul, B. (2026). Efficacy Of 0.1% Topical Finasteride Spray Solution for Male Eyebrow Enhancement: A Randomized, Double-Blind, Placebo-Controlled, Split-Face Comparative Pilot Study. *Procedia of Multidisciplinary Research*, 4(1), 1.

INTRODUCTION

Eyebrows are essential not only for facial aesthetics and non-verbal communication but also for protecting the eyes from external irritants (Nguyen, 2014; Cunningham et al., 1995). Eyebrow hypotrichosis, defined as a reduction or loss of eyebrow hair, may result from multiple etiologies (Chanasumon et al., 2018; Mumford et al., 2023). This condition can significantly affect self-esteem and psychological well-being in male patients (Riahi & Cohen, 2018).

A variety of cosmetic and medical approaches has been used in practice, including makeup, tattooing, topical pharmacologic agents, and surgical restoration through eyebrow transplantation. Nevertheless, no standard therapy has been established, and evidence to guide treatment in eyebrows remains limited.

Although topical finasteride has demonstrated well-established efficacy in scalp androgenetic alopecia (AGA), no prior studies have evaluated topical finasteride for eyebrow enhancement in male subjects, and data regarding its effect on eyebrow-specific endpoints remain absent. This pilot study therefore aimed to investigate the efficacy and safety of a 0.1% topical finasteride spray solution for male eyebrow enhancement using a randomized, double-blind, placebo-controlled, split-face design.

Research Objective

1. Primary Objectives

To study the efficacy of 0.1% topical finasteride spray solution for male eyebrow enhancement by comparing treatment outcomes from global photographic score between the experimental group and the control group.

2. Secondary Objectives

To study the efficacy of 0.1% topical finasteride spray solution for male eyebrow enhancement by comparing treatment outcomes from the changes in average hair diameter, changes in average hair count, and patient satisfaction between the experimental group and the control group.

To study the safety of 0.1% topical finasteride spray solution for male eyebrow enhancement.

LITERATURE REVIEW

Theory, Concept and Related Research

Eyebrow hypotrichosis has multiple causes including autoimmune diseases, hormonal and endocrine disorders, infections, trauma, and genetic abnormalities (Nguyen et al., 2023; Mumford et al., 2023). Nevertheless, no universally accepted standard therapy has been established for this condition, and management strategies remain varied. Current treatment options include topical agents such as minoxidil and bimatoprost as well as surgical approaches like hair transplantation. Minoxidil 1–2% has shown significant improvement in eyebrow density but may cause contact dermatitis (Lee et al., 2014; Worapunpong & Tanglertsampan, 2017). Bimatoprost 0.01–0.03% is also effective, with reports of fewer local adverse effects (Suchonwanit et al., 2020a). Surgical treatments can yield permanent results, however, they are costly, invasive, require technical expertise, and carry risks including scarring and infection (Epstein, 2013).

Mechanism

Finasteride, a type II 5α-reductase inhibitor, has shown robust evidence in the treatment of scalp androgenetic alopecia by inhibiting dihydrotestosterone (DHT) at the follicular level (Gupta et al., 2021; Piraccini et al., 2022). To limit systemic absorption associated with oral therapy, topical finasteride formulations have been developed and have shown promising efficacy in scalp hair regrowth with reduced systemic side-effect profiles (Caserini et al., 2014; Hajheydari et al., 2009; Gupta & Talukder, 2022). Given the presence of androgen receptors in eyebrow hair follicles and the potential local DHT activity, it is biologically plausible that finasteride may promote eyebrow hair growth (Kaufman, 2002; Suchonwanit et al., 2022).

Topical finasteride has never been evaluated for eyebrow enhancement, and prior evidence has focused exclusively on scalp follicles. The main research gap is therefore the absence of eyebrow-specific clinical trials and the lack of longitudinal data using blinded photographic scales and objective endpoints. This gap supported the rationale for conducting this pilot split-face RCT to compare 0.1% topical finasteride spray solution with placebo in male eyebrow hypotrichosis.

Research Framework

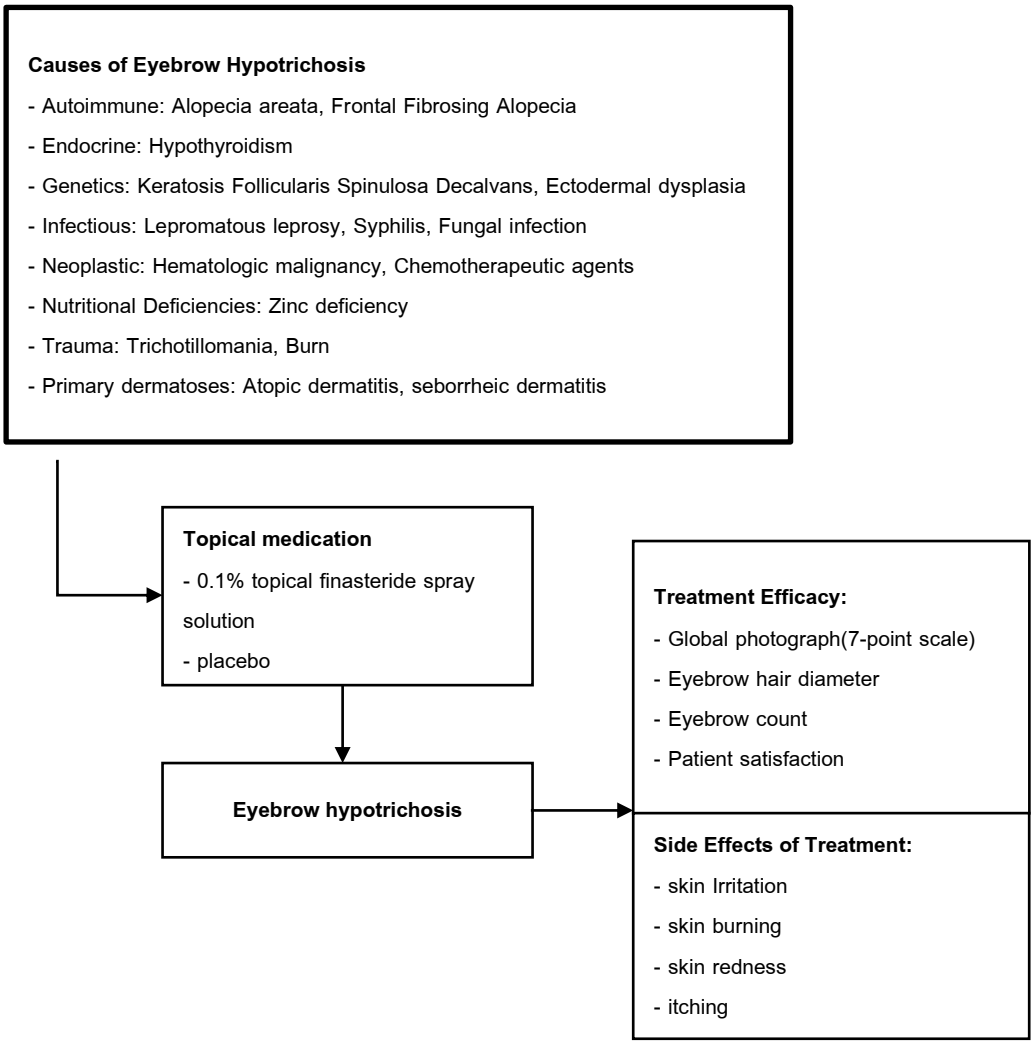

Figure 1 Research Framework

RESEARCH METHODOLOGY

Research Design

This pilot study was conducted as a randomized, double-blind, placebo-controlled, split-face trial to evaluate the efficacy and safety of 0.1% topical finasteride spray solution in male subjects with eyebrow hypotrichosis.

Population and Sample

The study population consisted of male patients aged 18 to 45 years attending the dermatology clinic at Mae Fah Luang University Hospital in Bangkok. Participants were eligible for inclusion if they had eyebrow hypotrichosis classified as grade I to II according to the Global Eyebrow Assessment (GEBA) scale, were currently receiving care at the study site, and expressed willingness to participate. Exclusion criteria included the presence of underlying systemic or dermatologic conditions known to affect eyebrow hair growth, such as alopecia areata, frontal

fibrosing alopecia, thyroid disease, hematologic malignancy, autoimmune disorders, infections (e.g.,syphilis, leprosy, fungal infections), or any history of eye or periorbital surgery. Patients who had received treatments affecting eyebrow hair growth within the past six months for example minoxidil, finasteride, bimatoprost, antiandrogens, laser/light therapy, or hair transplantation were also excluded. Additional exclusions applied to individuals with known hypersensitivity to finasteride, history of infertility, varicocele, or any contraindications to topical finasteride use.

As a pilot study, no formal sample size calculation was performed.

Randomization and Blinding

Randomization was performed at the individual level for each eyebrow using a coin-flip method: heads assigned the right eyebrow to finasteride and left to placebo, and tails reversed the assignment. The treatments were dispensed in identical opaque 15 ml spray bottles labeled A and B. Both solutions (finasteride and placebo) were colorless, odorless, and identical in appearance and packaging to preserve blinding. Neither the two blinded investigators conducting assessments nor the participants knew which side received active treatment.

Materials and Equipment

1. 0.1% Topical Finasteride Spray: Compounded by COSMINA Co., Ltd., GMP-certified, in ethanol/propylene glycol/water base, 1 mg/mL concentration.
2. Placebo Spray: Identical solvent base without active ingredient.
3. VISIA Imaging System (Canfield Scientific): Used for standardized photographic assessments at weeks 0, 4, 8, and 12.
4. Folliscope (LeadM Corp): Used to measure average eyebrow hair count and diameter at weeks 0, 4, 8, and 12.
5. Case Record Form (CRF): Documented participant data, including demographics, clinical findings, and adverse events.
6. Side Effect and Satisfaction Forms: Recorded patient-reported outcomes, 7-point scale satisfaction ratings at weeks 12, and side effect profiles at weeks 4, 8, and 12.

Research Procedures

After providing informed consent, participants underwent a medical history review and physical examination. Standardized global photographs were taken using the VISIA system. Eyebrow hair count and diameter were measured at a fixed point (the center of the eyebrow aligned with the mid-pupillary line) using the Folliscope. Each participant performed a 7-day Repeated Open Application Test (ROAT) on both forearms with the assigned solutions to detect contact sensitivity. Participants were instructed to apply one spray of the assigned solution to each eyebrow twice daily (morning and evening) on clean, dry eyebrows. Special emphasis was placed on avoiding cross-contamination between sides. Follow-up assessments were conducted at weeks 4, 8, and 12, during which global photographic scores, hair count, diameter, and adverse events were recorded. Patient satisfaction ratings were collected at week 12. Treatment adherence was reinforced by requiring participants to bring their medication bottles to each follow-up visit. Upon study completion, placebo-treated sides were offered topical minoxidil treatment if the finasteride-treated side showed clinical efficacy.

Data Analysis and Statistics

Categorical data, including global photographic assessment scores and the incidence of side effects, were summarized using frequencies and percentages. Continuous variables such as age, average eyebrow hair diameter, and hair count were assessed for normality and reported as mean and standard deviation (SD). To evaluate treatment efficacy, repeated measures ANOVA was used to compare the mean changes in global photographic scores, eyebrow hair diameter, and hair count between the 0.1% topical finasteride group and the placebo group over time. Additionally, repeated measures ANOVA was applied to analyze changes from baseline within each treatment side for both diameter and hair count. Participant satisfaction was compared

between the two treatment groups using the McNemar test. The incidence of treatment-related side effects was also analyzed using the McNemar test to determine statistical significance between groups. A p-value of less than 0.05 was considered statistically significant for all analyses.

RESEARCH FINDINGS

Demographic Data of the Participants

A total of 8 male participants diagnosed with eyebrow hypotrichosis were enrolled and completed the 12-week study. The mean age of participants was 37.9 ± 2.5 years. Based on the Global Eyebrow Assessment (GEBA) scale, 3 participants presented with Grade 1 hypotrichosis, while 5 participants were classified as Grade 2. 7 participants reported no underlying medical conditions, while 1 participant reported a history of hypertension. None had a history of drug or chemical allergies. Treatment allocation using the coin-flip method resulted in an even distribution, with 50% of participants receiving the finasteride spray on the right eyebrow and 50% on the left. This balance was maintained for placebo application as well.

A total of 8 male participants diagnosed with eyebrow hypotrichosis were enrolled and completed the 12-week study. The mean age of participants was 37.9 ± 2.5 years. Based on the Global Eyebrow Assessment (GEBA) scale, 3 participants presented with Grade 1 hypotrichosis, while 5 participants were classified as Grade 2. Seven participants reported no underlying medical conditions, and one participant reported a history of hypertension. None had a history of drug or chemical allergies. Treatment allocation using the coin-flip method resulted in an even distribution, with 50% of participants receiving the finasteride spray on the right eyebrow and 50% on the left, baseline hair diameter, skin condition at the fixed measurement point, and treatment adherence were comparable between both eyebrows in all participants. This balance was maintained for placebo application as well.

Primary Outcome: Global Photographic Assessment

The finasteride-treated eyebrows showed significantly greater improvement in global photographic scores compared with the placebo-treated side at all time points. Mean scores were higher in the finasteride group at week 4 (1.25 ± 0.46 vs. 0.25 ± 0.46; P = 0.008) and at weeks 8 and 12 (2.00 ± 0.76 vs. 0.75 ± 0.71; P = 0.002 for both). By week 12, improvement was observed in all participants on the finasteride-treated side.

Within-group analysis demonstrated a significant increase in global photographic scores over time for both treatments, with a stronger effect in the finasteride-treated side (repeated-measures ANOVA, P = 0.006; baseline vs. week 12, P < 0.001) compared with the placebo-treated side (P = 0.033; baseline vs. week 12, P = 0.020). Post hoc analysis showed an early and progressive improvement with finasteride by week 4, plateauing after week 8, whereas placebo-treated eyebrows exhibited only mild and delayed improvements from week 8 onward.

Figure 2 Global photographic scores by treatment group

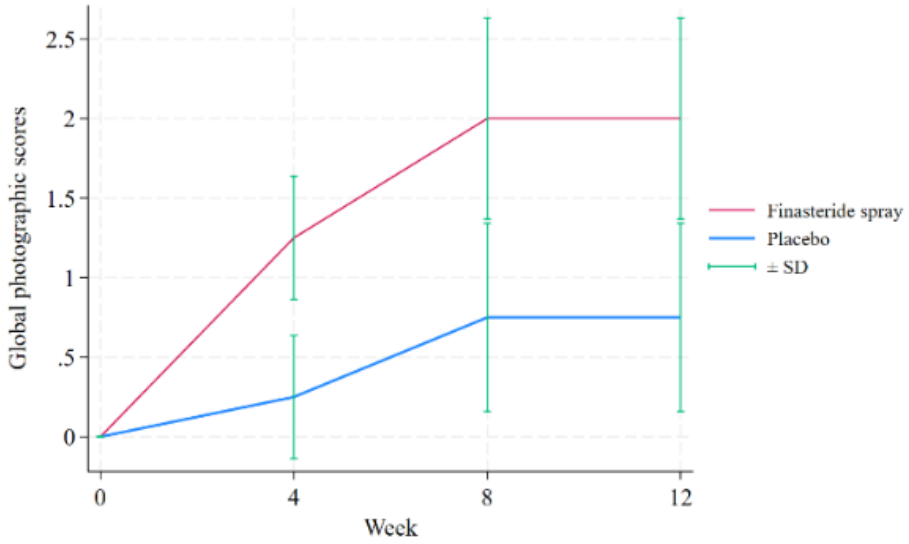

Table 1 comparison global photographic scores of both eyebrows

Week	**Finasteride spray**	**Placebo**	**P-value**
	Mean ± SD	**Mean ± SD**	
0	0 ± 0	0 ± 0	NA
4	1.25 ± 0.46	0.25 ± 0.46	0.008
8	2 ± 0.76	0.75 ± 0.71	0.002
12	2 ± 0.76	0.75 ± 0.71	0.002
P-value for compare photographic scores among week within treatment group			
Repeadted ANOVA	0.006	0.033	
P-value compare within group			
0 vs 4	<0.001	0.171	
0 vs 4	<0.001	0.171	
0 vs 8	<0.001	0.020	
0 vs 12	<0.001	0.020	
4 vs 8	0.020	0.033	
4 vs 12	0.020	0.033	
8 vs 12	0.999	0.999	

P-value was evaluated by Repeated measure ANOVA test

Secondary outcome

Eyebrows hair count

At baseline, the placebo-treated side had a higher mean eyebrow hair count than the finasteride-treated side (49.4 ± 7.0 vs. 43.9 ± 8.2 hairs; P = 0.037). To manage variability between eyebrows, the protocol specified assessment of outcomes as change from baseline using a repeated-measures ANOVA approach. Over 12 weeks, the finasteride-treated side demonstrated a greater increase in hair count, reaching statistical significance by week 8 (P = 0.036) and remaining significant at week 12 (68.6 ± 10.8 vs. 54.3 ± 13.2 hairs; P = 0.008).Within-group analysis showed a significant increase in eyebrow hair count over time in the finasteride-treated side (repeated-measures ANOVA, P < 0.001; baseline vs. week 12, P < 0.001), whereas no significant change was observed in the placebo-treated side (P = 0.109). The enrollment size of n=8 was recorded as part of the pilot design, and the presence of baseline difference was documented in the study dataset.

Table 2 Comparison of hair count between finasteride and placebo

Week	**Finasteride spray**	**placebo**	**P-value**
	Mean ± SD	**Mean ± SD**	
0	43.9 ± 8.2	49.4 ± 7.0	0.037
4	56.0 ± 9.2	52.4 ± 15.3	0.575
8	65.1 ± 9.8	57.1 ± 10.2	0.214
12	68.6 ± 10.8	54.3 ± 13.2	0.030
P-value for compare hair count among week within treatment group			
Repeated ANOVA	<0.001	0.109	
P-value compare within group [b]			
0 vs 4	0.012	0.449	
0 vs 8	<0.001	0.020	
0 vs 12	<0.001	0.237	
4 vs 8	0.061	0.093	

4 vs 12	0.024	0.563
8 vs 12	0.519	0.261

P-value was evaluated by Repeated measure ANOVA test

Table 3 Comparison of change in hair count from baseline between finasteride and placebo

Week	**Finasteride spray**	**placebo**	**P-value[a]**
	Mean ± SD	**Mean ± SD**	
4	12.1 ± 10.3	3 ± 10.6	0.144
8	21.3 ± 9.3	7.8 ± 7.3	0.036
12	24.8 ± 10.6	4.8 ± 10.7	0.008

a P-value was evaluated by Repeated measure ANOVA test

Eyebrows hair diameter

At baseline, the mean eyebrow hair diameter was similar between the finasteride-treated (0.09 ± 0.02 mm) and placebo-treated (0.08 ± 0.02 mm) sides, with no statistically significant difference (P = 0.070). Throughout the 12-week period, the finasteride-treated eyebrows showed values of 0.09 ± 0.01 mm, while the placebo side remained at 0.08 ± 0.01–0.02 mm. Between-group comparisons at weeks 4, 8, and 12 demonstrated statistically significant differences in absolute diameter values (P = 0.016, 0.038, and 0.031, respectively), however, the within-group change in diameter from baseline was minimal and did not reach statistical significance on either side. This section therefore reports the findings on diameter as stable absolute measurements rather than treatment-related thickening within 12 weeks.

Table 4 Comparison of hair diameter from baseline between finasteride and placebo

Week	**Finasteride spray**	**Placebo**	**P-value**
	Mean ± SD	**Mean ± SD**	
0	0.09 ± 0.02	0.08± 0.02	0.070
4	0.09 ± 0.01	0.08 ± 0.02	0.016
8	0.09 ± 0.01	0.08 ± 0.01	0.038
12	0.09 ± 0.01	0.08 ± 0.01	0.031
P-value for compare average hair diameter **among week within treatment group**			
Repeated ANOVA	0.992	0.858	

P-value was evaluated by Repeated measure ANOVA test

Patient satisfaction

At week 12, all eight participants reported a subjective improvement on the finasteride-treated side using the 7-point scale. In contrast, six participants reported improvement on the placebo side. Despite the numerical advantage favoring finasteride, McNemar ’s test did not show statistical significance (P = 0.157), likely due to small sample size. Participants subjectively described better eyebrow “density” and “definition” on the finasteride side during the exit interview, though no formal qualitative metrics were applied.

Side effects

Topical finasteride was well tolerated, with no serious or systemic side effects observed throughout the study. At week 4, one case of mild pruritus was reported on the placebo-treated side only. By weeks 8 and 12, mild pruritus occurred in one participant (12.5%) on each side. All reported side effects were mild, localized, and self-resolving, and no participants withdrew from the study due to adverse events.

CONCLUSION & DISCUSSION

This pilot randomized; split-face trial provides preliminary evidence suggesting that 0.1% topical finasteride spray is associated with improvement in male eyebrow hypotrichosis. Indications of

benefit were observed primarily in blinded global photographic assessment scores and in the progressive increase in eyebrow hair count on the finasteride-treated side compared with placebo. Potential changes in hair diameter were minimal during the 12-week period and require longer observation, indicating that diameter is a slower kinetic endpoint not adequately captured within this pilot timeframe and that the significant between-side differences in absolute values may reflect residual baseline variability, therefore the results warrant further investigation in larger, adequately powered studies to confirm true androgen-mediated activity of eyebrow follicles and to characterize long-term response. While patient satisfaction showed a positive trend with finasteride, the difference was not statistically significant, possibly due to the small sample size. Nevertheless, qualitative feedback obtained during exit interviews suggested subjectively improved eyebrow "density" and "definition" on the finasteride-treated side, providing contextual support for the objective findings despite the lack of statistical significance in patient-reported scores. Importantly, the intervention was well tolerated, and current data show no signals of systemic adverse effects, supporting the short-term safety of localized use.

Limitations

Consistent with the pilot nature of this trial, the extremely small sample size (n=8) represents the most prominent limitation and fundamentally restricts the statistical power, generalizability, and the level of confidence in drawing conclusions. Although the study employed a randomized split-face design and evaluated outcomes as change from baseline to reduce inter-eyebrow variability and to address the initial imbalance in hair count, a residual effect cannot be entirely excluded, particularly within the 12-week observation period and small sample size. Therefore, the findings should be interpreted as exploratory and hypothesis-generating rather than definitive proof, and they cannot be generalized to a broader population of male patients seeking eyebrow enhancement.

Future Directions

Future research should focus on larger, adequately powered studies with a formal sample size calculation and across diverse populations, incorporate standardized patient-reported outcome measures, and include extended follow-up periods to evaluate long-term effectiveness and delayed safety outcomes. Optimization of formulation and delivery methods also merits further study to enhance skin penetration while maintaining minimal systemic exposure.

Acknowledgement

I would like to express my sincere gratitude to my personal support network for their unwavering encouragement and understanding throughout this research journey. I would also like to thank my professor for providing valuable guidance and inspiration that helped shape this work.

REFERENCES

Caserini, M., Radicioni, M., Leuratti, C., Annoni, O., & Palmieri, R. (2014). A novel finasteride 0.25% topical solution for androgenetic alopecia: pharmacokinetics and effects on plasma androgen levels in healthy male volunteers. Int. Journal of Clinical Pharmacology and Therapeutics, 52(10), 842–849.

Chanasumon, N., Sriphojanart, T., & Suchonwanit, P. (2018). Therapeutic potential of bimatoprost for the treatment of eyebrow hypotrichosis. In Drug Design, Development and Therapy (Vol. 12, pp. 365–372). Dove Medical Press Ltd.

Cunningham, M. R., Roberts, A. R., Barbee, A. P., Druen, P. B., & Wu, C. H. (1995). " Their ideas of beauty are, on the whole, the same as ours": Consistency and variability in the cross-cultural perception of female physical attractiveness. Journal of personality and social psychology, 68(2), 261.

Epstein, J. (2013). Facial Hair Restoration. Facial Plastic Surgery Clinics of North America, 21(3), 457–467.

Gupta, A. K., Venkataraman, M., Talukder, M., & Bamimore, M. A. (2021). Finasteride for hair loss: a review. Journal of Dermatological Treatment, 33(4), 1938–1946.
Gupta, A. K., & Talukder, M. (2022). Topical finasteride for male and female pattern hair loss: Is it a safe and effective alternative? Journal of Cosmetic Dermatology, 21(5), 1841–1848.
Hajheydari, Z., Akbari, J., Saeedi, M., & Shokoohi, L. (2009). Comparing the therapeutic effects of finasteride gel and tablet in treatment of the androgenetic alopecia. Indian Journal of Dermatology, Venereology and Leprology, 75(1), 47
Kaufman, K. D. (2002). Androgens and alopecia. Molecular and Cellular Endocrinology, 198(1–2), 89–95.
Lee, S., Tanglertsampan, C., Tanchotikul, M., & Worapunpong, N. (2014). Minoxidil 2% lotion for eyebrow enhancement: A randomized, double-blind, placebo-controlled, spilt-face comparative study. The Journal of Dermatology, 41(2), 149–152.
Mumford, B. P., Eisman, S., & Yip, L. (2023). Acquired causes of eyebrow and eyelash loss: A review and approach to diagnosis and treatment. In Australasian Journal of Dermatology (Vol. 64, Issue 1, pp. 28–40). John Wiley and Sons Inc.
Nguyen, J. V. (2014). The biology, structure, and function of eyebrow hair. Journal of Drugs in Dermatology: JDD, 13(1 Suppl), s12-6.
Nguyen, B., Hu, J. K., & Tosti, A. (2023). Eyebrow and Eyelash Alopecia: A Clinical Review. In American Journal of Clinical Dermatology (Vol. 24, Issue 1, pp. 55–67). Adis.
Piraccini, B. M., Blume-Peytavi, U., Scarci, F., Jansat, J. M., Falqués, M., Otero, R., . . . Massana, E. (2022). Efficacy and safety of topical finasteride spray solution for male androgenetic alopecia: a phase III, randomized, controlled clinical trial. Journal of the European Academy of Dermatology and Venereology, 36(2), 286–294.
Riahi, R. R., & Cohen, P. R. (2018). Topical treatment of eyebrow hypotrichosis with bimatoprost 0.03% solution: case report and literature review. Cureus, 10(5).
Suchonwanit, P., Harnchoowong, S., Chanasumon, N., & Sriphojanart, T. (2020). Comparison of the efficacy and safety of using 0.01% versus 0.03% bimatoprost for the treatment of eyebrow hypotrichosis: A randomized, double-blind, split-face, comparative study. Journal of Cosmetic Dermatology, 19(3), 714–719.
Suchonwanit, P., Iamsumang, W., & Leerunyakul, K. (2022). Topical finasteride for the treatment of male androgenetic alopecia and female pattern hair loss: a review of the current literature. Journal of Dermatological Treatment, 33(2), 643–648.
Worapunpong, N., & Tanglertsampan, C. (2017). Treatment of Eyebrow Hypotrichosis with 1% Minoxidil Lotion: A Prospective, Randomized, Double-Blind, Placebo-Controlled Trial. J Med Assoc Thai, 100(5).

Data Availability Statement: The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Conflicts of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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