Androgenetic Alopecia (AGA)

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Androgenetic Alopecia (AGA): Pharmacologic and Alternative Treatments for Hair Loss

Conflict of Interest and Disclosures

We have no conflicts and nothing to disclose

1. Most common form of non-scarring alopecia
2. Affects roughly 50 million men and 30 million women in the United States.1,3
3. Result of the gradual miniaturization of individual hair follicles due to a complex interaction between genetic susceptibility and hormone interactions.4,5
Pathophysiology of AGA

- Each hair follicle transitions through three key phases: anagen (growth), catagen (involution), and telogen (rest) stages.\(^2\)\(^4\)\(^7\)\(^8\)

- AGA shortens anagen, causing miniaturization of hair follicles, and replacement of terminal hairs with barely visible vellus hairs.\(^2\)\(^4\)\(^5\)

- The actions of dihydrotestosterone (DHT) are well characterized in male pattern hair loss but are less certain in female pattern hair loss.\(^4\)

  - The Type II isoform of 5-alpha reductase (5-AR) metabolizes testosterone to DHT.\(^2\)\(^5\)\(^6\)

  - Elevated androgen metabolism at the level of the hair follicle leads to receptor binding and activation of genes resulting in miniaturization of hair follicles.\(^2\)\(^4\)\(^5\)

Current Therapeutic Options

- Each year, consumers spend millions of dollars on hair restoration products, but therapeutic options are limited.\(^3\)

- There are only two United States Food and Drug Administration (FDA) approved therapies for the treatment of AGA.\(^2\)

  - Oral finasteride: prescription only inhibitor of 5-AR.\(^2\)\(^4\)\(^8\)

  - Topical minoxidil: over-the-counter potassium channel opener and vasodilator

- Additional treatment modalities available to patients but rigorous scientific evidence is lacking.\(^3\)

The Problem

- Alopecia may lead to distress, anxiety, and/or depression.\(^4\)\(^9\)

  - Cosmetic market saturated with alternative treatments claiming hair regrowth properties.
Our Study

Title: The diverse landscape of alternative hair growth ingredients for patients with androgenetic alopecia

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Currently under peer review for publication in Dermatology Online Journal

Study Objective

In this consumer market search, our aim was to identify and analyze the efficacy of the top five common hair regrowth agents available to consumers in shampoo formulations.

Methods

Used Amazon.com to search for hair regrowth shampoos
50 shampoos reviewed in total
Ingredient names inserted into a Structured Query Language (SQL) database table
Allows for easy aggregations and counts on unique ingredient names
Ingredients found in 2+ shampoo formulations were categorized using a simple internet search, the PubChem Compound Database, the Environmental Working Group's (EWG's) Skin Deep® Cosmetics Database, and/or Cosmeticsinfo.org
Ingredients classified under hair growth were considered active.
Results

Total of 473 unique ingredients were identified among the selected top 50 shampoos.

62 ingredients classified as having hair growth properties.

Top 5 hair growth agents:
- coconut oil
- vitamin B7 (biotin)
- aloe vera (Aloe barbadensis)
- saw palmetto extract (Serenoa repens)
- rosemary oil (Rosmarinus officinalis)

Top 5 Hair Growth Ingredients

<table>
<thead>
<tr>
<th>Ingredient Name</th>
<th>Shampoos Containing Ingredient (N = 50)</th>
<th>Ingredient Prevalence in Shampoos (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coconut Oil</td>
<td>45</td>
<td>90%</td>
</tr>
<tr>
<td>Vitamin B7 (Biotin)</td>
<td>30</td>
<td>60%</td>
</tr>
<tr>
<td>Aloe Vera</td>
<td>24</td>
<td>48%</td>
</tr>
<tr>
<td>Saw Palmetto Extract</td>
<td>20</td>
<td>40%</td>
</tr>
<tr>
<td>Rosemary Oil</td>
<td>18</td>
<td>36%</td>
</tr>
</tbody>
</table>

Coconut Oil

Anecdotal evidence suggests continued topical application of coconut oil to hair leads to healthy looking, long hair. The purported mechanism appears to be coconut oil’s lubricating effect on friction which reduces damage during combing. Radiolabeling coconut oil with tritium allowed researchers to quantify oil penetration into hair. Although coconut oil did infiltrate hair, the majority of the oil was found localized on the surface. Coconut oil may improve overall hair health and prevent damage but no evidence is available that shows categorical improvements in hair growth.
**Vitamin B7 (Biotin)**

- Cofactor for carboxylase enzymes
- Gluconeogenesis, lipogenesis, fatty acid synthesis, and protein catabolism.13,16
- Biotin deficiency linked to alopecia13,16
- Deficiency = <100ng/L
- Rare in well-developed countries
- Secondary causes:
  - Medication use (antiepileptics, isotretinoin, antibiotics) or gastrointestinal disease.13,16
- Case reports have demonstrated oral biotin's effectiveness in hair and nail growth disorders but only in patients with established biotin deficiency.17
- No data exists on topically administered biotin for hair regrowth.17

**Aloe Vera (Aloe barbadensis)**

- Consumers might be most familiar with aloe use in skin disorders ranging from eczema and psoriasis, to acne and burn healing.18,19
- Contains more than 75 active ingredients18,20 complicating researchers ability to link product to therapeutic effect.
  - Has shown anti-inflammatory activity in animal studies and antimicrobial activity in vitro.18,20
- These effects are frequently linked to unsubstantiated claims of improved hair growth. Without explicit study, consumers should be wary of online articles suggesting improvements in hair growth.

**Saw Palmetto Extract (Serenoa repens)**

- Multiple Mechanisms of Action:
  - Inhibits 5-Alpha reductase
  - Blocks 50% of DHT binding to androgen receptors
  - Increases conversion of DHT to the weaker androgen, androstanediol (enhances activity of 3α-hydroxysteroid dehydrogenase).4,12,20
- Rossi et al (2012)21
  - Oral saw palmetto + Beta-sitosterol vs. placebo
- Prager et al (2002)25
  - Comparison of finasteride 1mg/day vs. oral saw palmetto 320mg/day taken daily x2 years
- Wessagowitt et al. (2016)23
  - Topical saw palmetto extract 3.3 mL serum x4 weeks, 2mL lotion x24 weeks
Rosemary Oil (*Rosmarinus officinalis*)

- In a mouse model, rosemary oil improved hair growth, inhibited 5-AR, and prevented DHT binding to androgen receptors.\(^{26}\)
- In 100 male patients, aged 18-49 years with AGA, topically administered rosemary oil was compared to minoxidil 2%.\(^{24}\)
  - Both products were applied twice daily and each group experienced significant improvements in hair count at 6 months.\(^{24}\)

Conclusion

- Saw palmetto and rosemary oil have reasonable evidence for their topical use in a normally healthy individual
- Study Limitations:
  - Our study reviewed agents promoting hair growth found within shampoos and did not include a review of oils, creams, foams, or oral therapies.
  - Amazon products are only a snapshot in the vast landscape of products
- Primary care physicians are on the first point of contact for patients struggling with AGA
  - Need to be aware of some the ingredients found in OTC products to better inform and help patients

Questions?
References


22. Prager N, Marcovici G. A Randomized, Double-Blind, Placebo-Controlled Trial to Determine the Effectiveness of Botanically Derived Inhibitors of 5-a-Reductase in the Treatment of Androgenetic Alopecia.


14. Rele AS, Mohile RB. Effect of mineral oil, sunflower oil, and coconut oil on prevention of hair damage.


10. Sonthalia S. Hair Restoration in Androgenetic Alopecia: Looking Beyond Minoxidil, Finasteride and Hair Transplantation.


7. Prager N, Marcovici G. A Randomized, Double-Blind, Placebo-Controlled Trial to Determine the Effectiveness of Botanically Derived Inhibitors of 5-a-Reductase in the Treatment of Androgenetic Alopecia.

6. Prager N, Marcovici G. A Randomized, Double-Blind, Placebo-Controlled Trial to Determine the Effectiveness of Botanically Derived Inhibitors of 5-a-Reductase in the Treatment of Androgenetic Alopecia.

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References (cont.)


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