IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

A Review Article On DHT-Blocking Herbs For Anti Hair Loss Shampoo

Ashutosh Sinha[1], Khushal Singh[1], Shubham[1], Rahul[1], Dr. Chanchala Chandel[2].

[1]Students of Lala Birkha Ram College of Pharmacy, Golpura, Panchkula.

[2]Assistant Professsor of Lala Birkha Ram College of Pharmacy, Golpura, Panchkula.

ABSTRACT –

This study aims to develop and evaluate a safe, effective, and high-quality herbal Shampoo, focusing on its DHT-blocker properties. Herbal Shampoos offer a natural approach to hair care, cleansing the hair and scalp of dirt, grease, and dandruff while promoting healthy hair growth, strength, and color. [1] They can also improve hair's softness, smoothness, and shine. Conventional Shampoos often contain chemical ingredients that may cause adverse effects such as hair loss, scalp irritation, discomfort, nausea, and headaches. Therefore, this research explores the formulation of an herbal Shampoo that topicaly blocks the DHT, minimizing the risk of such side effects.

KEYWORDS – Introduction, Herbal Shampoo, DHT blocking Shampoo.

1. INTRODUCTION

1.1. Herbal Shampoo

Shampoo is among the most commonly used cosmetic products for cleansing hair and scalp. Herbal Shampoos, formulated with traditional Ayurvedic herbs, offer a natural alternative to conventional Shampoos for cleansing. They effectively remove oil, dandruff, dirt, and environmental pollutants. Essentially, herbal Shampoos are plant-based cosmetic preparations designed to replace synthetic Shampoos.

Shampoo is typically applied to wet hair, massaged into the scalp and hair, and then rinsed out. Its primary function is to cleanse the hair by removing accumulated dirt and debris without excessively stripping away the natural oils (sebum). While the market offers a wide variety of synthetic Shampoos, both medicated and non-medicated, herbal Shampoos have gained popularity due to their natural composition, perceived safety, increased consumer demand, and potential to be free from harsh side effects [1-3].

1.2. What is DHT

DHT is male sex hormone with androgenic properties. DHT is produced when the body converts another hormone called testosterone. Therefore, the levels of DHT in the body are directly related to the amount of testosterone available for conversion. As testosterone level rise, DHT levels also increases. Gonalds is responsible for the production of testosterone.
Testosterone, the primary male androgen, is converted to the more potent androgen 5α-dihydrotestosterone (DHT) by the enzyme 5α-reductase, using NADPH as a cofactor. This conversion is crucial because DHT binds more strongly to the androgen receptor (AR) than testosterone [7].

There are two isoforms of 5α-reductase, type I and type II, which differ in their tissue distribution and their ability to convert testosterone to DHT. These isozymes are found in sebaceous glands and hair follicles, where they play a key role in mediating androgen action and influencing the development of baldness (Androgenic Alopecia or Male Pattern Baldness) [8].

Only 5-7% of testosterone is converted to DHT via 5α-reduction, resulting in approximately 200-300 μg of DHT produced daily. While the majority of DHT is synthesized in peripheral tissues such as the skin and liver, most circulating DHT originates from the liver. The testes and prostate contribute minimally to circulating DHT levels[9][10].

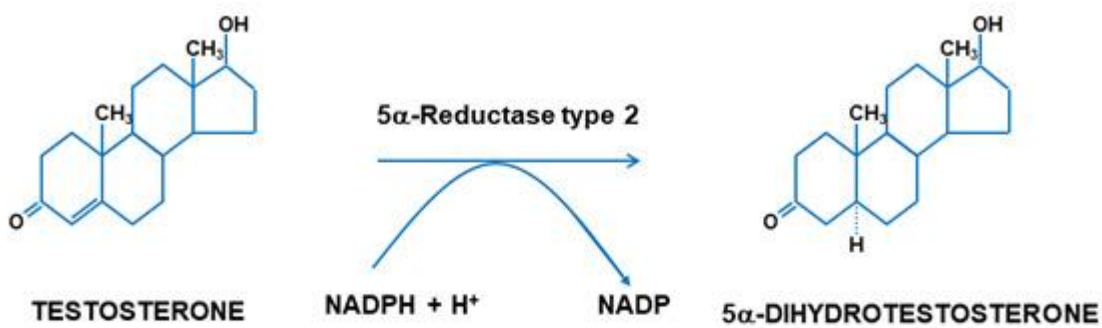


Figure 3. Conversion of Testosterone into 5α-Dihydrotestosterone (Modified photo from NCBI)

1.3. Androgen Action on Hair Follicles

Androgens play a crucial role in hair growth, although their effects vary depending on the hair's location on the body. The significant rise in androgen levels during puberty triggers the transformation of fine, vellus hair into thicker, terminal hair in the pubic and axillary regions [11]. Androgen stimulate hair growth in areas like the face, axilla, pubic region, and chest. However, eyelash hair follicles are unaffected by androgens.

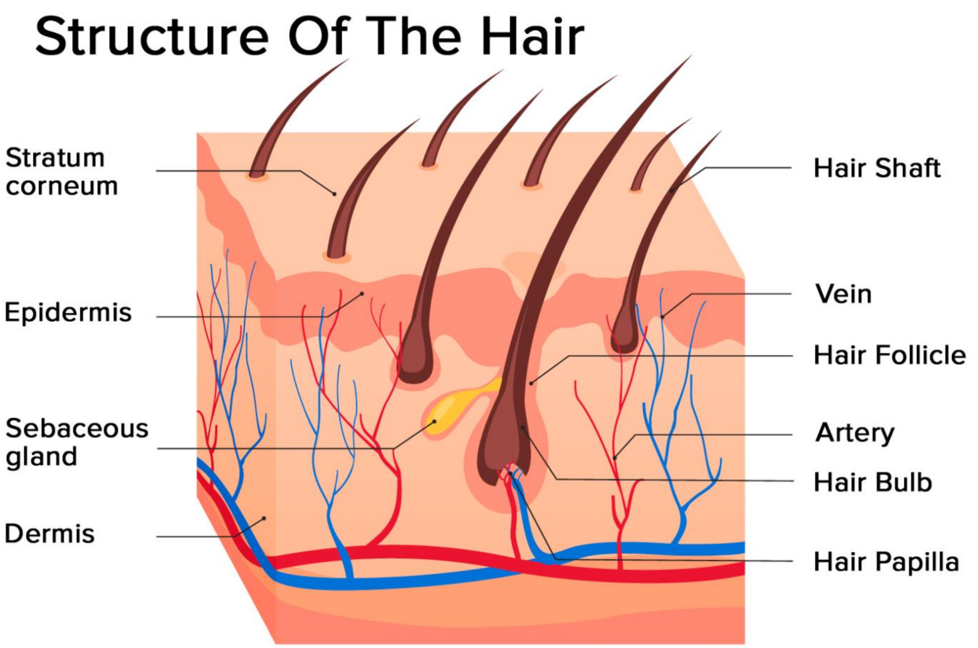
While androgens stimulate hair growth in some areas, they paradoxically inhibit it on the scalp.Hair follicles, both healthy and affected, contain androgen-metabolizing enzymes crucial for hair follicle function. These enzymes are distributed throughout the follicles: the outer root sheath contains aromatase, 17 β- HSD, and 5α- reductase (types I and II); the inner root sheath contains aromatase and 5α- reductase (types I and II); and the dermal papilla contains aromatase, 17 β- HSD, 5α-reductase (types I and II) and sulfatase. In the sebaceous gland, contains aromatase and 5α- reductase (types I) are present, while the sebaceous duct contains 5α- reductase [12].

1.4. Hair Follicles Biology

1.4.1. Structure of the hair

Hair, primarily composed of dead, keratinized cells, exists as a filament. It has two main structural components: the hair follicle and the hair shaft (Figure 1).

Figure 1. Structure of the hair: hair follicle and hair shaft (modified photo from Freepik).



Hair follicles are structurally organized into upper and lower segments. The upper segment comprises the infundibulum and isthmus, while the lower segment includes the bulb and the suprabulbar region. The hair bulb itself is composed of the dermal papilla, a collection of specialized fibroblasts, capillaries, and nerve endings, and the hair matrix, which consists of rapidly dividing keratinocytes. Scalp hair follicles are anchored in the subcutaneous tissue and exhibit cyclical growth patterns[4] .

The hair shaft comprises three layers: the cuticle, cortex, and medulla. The outermost part of the hair is medulla, which is extending above the skin

1.4.2. The Hair Follicle Cycle

The hair follicle cycle is divided into three main distinct phases: the anagen, the catagen, and the telogen (figure 2). Some authors also identify one additional phase: the exogen.

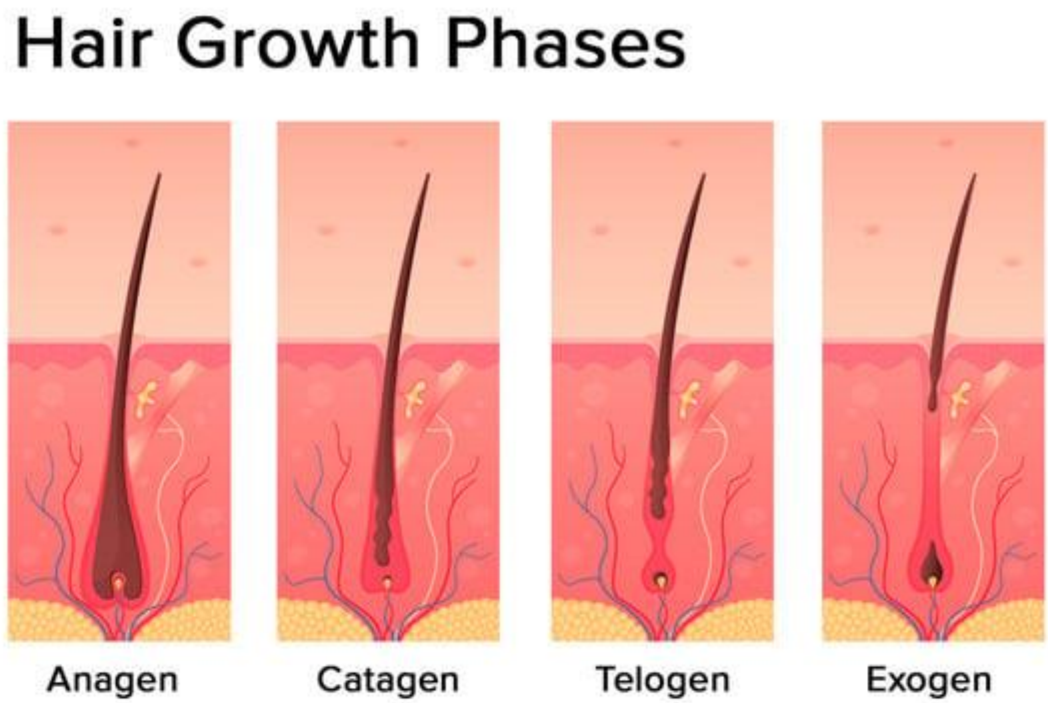


Figure 2. Hair growth phases: anagen (growing phase), catagen (transition phase), telogen (resting phase), exogen (shedding phase) (modified photo from Freepik).

The hair growth cycle consists of several distinct phases. Anagen, the active growth phase, is the longest, lasting 2-7 years. During anagen, rapid cell division occurs in the lower portion of the hair follicle, causing matrix cells to migrate outwards.

Catagen is a brief, transitional phase lasting approximately three weeks. It's characterized by follicle regression, as the hair shaft detaches from the dermal papilla and contracts.

Telogen, the resting phase, lasts about three months. During telogen, the hair matrix regresses, and the dermal papilla retracts to a position near the bulge. Cellular proliferation and apoptosis are minimal during this period.

Some researchers also describe an exogen, or shedding, phase, during which the old hair shaft is shed, and a new hair begins to grow.
At any given time, the majority of scalp hair (85-90%) is in the anagen phase. The remaining follicles are in either catagen (2%) or telogen (10-15%)[5]. However, recent data suggests that the percentage of hair in telogen may be lower than previously thought, perhaps only around 3.6% [6].

2. HERBAL MATERIALS

2.1. Herbs with DHT Blocking Properties

2.1.1. Saw palmetto (Serenoa repens)

Saw palmetto is an American medicinal plant belonging to the family Arecaceae. It is a member of the palm family. It occurs from the coast of South Carolina to Georgia. It is not found in India hence imported from USA. Saw palmetto berry extract has demonstrated success in treating androgenic alopecia. Saw palmetto acts as a multi-site inhibitor of dihydrotestosterone (DHT), the primary hormone responsible for androgenic alopecia. It reduces DHT's binding to receptors in target cells by approximately 50% [13].

It also prevents DHT from entering the nucleus of target cells and significantly inhibits the enzyme 5α-reductase, which converts testosterone to DHT [14].

A systematic review by Evron et al. examined the effects of saw palmetto in several human studies involving androgenetic alopecia, female pattern hair loss, telogen effluvium, and self-perceived hair thinning. The review indicated modest improvements in hair regrowth with various topical and oral saw palmetto supplements, including a 60% improvement in overall hair quality, a 27% increase in total hair count, increased hair density in 83.3% of patients, and stabilization of disease progression in 52% [15].

Saw palmetto's primary mechanism of action involves its anti-androgen properties. This characteristic has made it a popular treatment for benign prostatic hyperplasia for centuries, with historical records of its use dating back to ancient Egypt in the 15th century BCE [16].

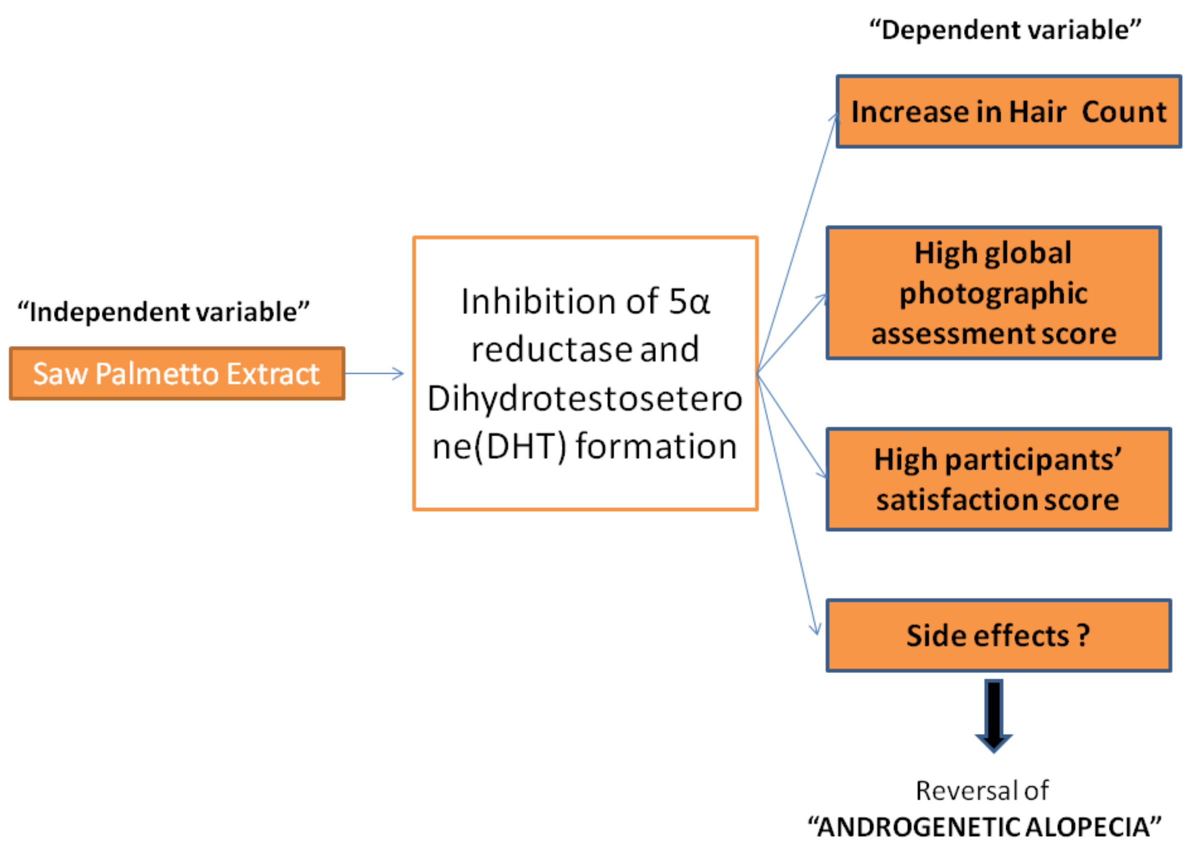


Figure :- Conceptual Framework (From [17]).

2.1.1.1. EXTRACTION OF SAW PALMATTO

Dried berries from the Saw Palmetto plant (Serenoa repens) are first ground into a fine powder to enhance the extraction process. This powdered material is then subjected to an alcohol extraction, where the alcohol acts as a solvent to dissolve and separate the valuable fatty acids from the plant matter. Subsequently, the alcohol is carefully removed under vacuum, a technique that lowers the boiling point and allows for gentle evaporation, leaving behind a concentrated extract. This resulting extract is standardized to contain a minimum of 85% free fatty acids, ensuring a consistent and potent product. It produced 98 % inhibition of 5 alpha reductase at the concentraction of 144 mcg/mL of SPLE [41].

2.1.2. Pumpkin Seed (Cucurbita pepo)

The pumpkin (Cucurbita pepo), a member of the Cucurbitaceae family, is a widely cultivated edible fruit, particularly common in the Americas and Europe. Pumpkin (Cucurbita pepo) seeds are used locally in Eritrea to treat tapeworm.

Its seeds are a nutritional powerhouse, boasting high levels of oil (around 35%), protein (approximately 38%), alpha-tocopherols (3 mg/100g), and carbohydrates (about 37%). The primary fatty acids in pumpkin seeds are oleic acid (29%) and linoleic acid (47%), as noted by Younis et al. (2000)[18].

Pumpkin seed oil is a good source of unsaturated fatty acids (78%) and phytosterols [19].

Studies have confirmed the nutraceutical benefits of pumpkin seed oil, demonstrating improvements in liver biomarkers, reduced lipoperoxidation, and anti-inflammatory and antioxidant effects[20,21,22,23].

While the exact mechanisms are still under investigation, it is suggested that pumpkin seed oil, likely due to its phytosterol content, may inhibit 5α-reductase, the enzyme responsible for converting testosterone to DHT [24,25].

Clinical studies have demonstrated the effectiveness of oral pumpkin seed oil treatment in men with mild to moderate androgenetic alopecia [26] and in women with female pattern hair loss [27].

Pre-clinical studies using a testosterone-induced model of androgenetic alopecia in mice have also shown positive results [28].

2.1.2.1. EXTRACTION OF PUMPKIN SEED

A. Oil Extraction

a. Oil Extraction By Solvent

Whole pumpkin seeds were ground into a fine powder using a heavy-duty grinder (Brown, Germany) and sieved through a 200-mesh stainless steel filter. The resulting powder was stored at 4 °C.

To extract the oil, the seed flour was defatted using three different solvents: pentane, hexane, and a chloroform/methanol mixture (3:1 v/v). A 1:10 (w/v) flour-to-solvent slurry was stirred for 24 hours.

The mixture was then centrifuged at 4 °C for 15 minutes, and the supernatant was filtered through a 0.45 µm Whatman filter. This extraction process was repeated three times.

The solvent was removed from the filtered extract using a rotary evaporator at 40 °C. The extracted seed oil was collected under a nitrogen atmosphere and stored at -20 °C for further analysis.

The pumpkin seed oils obtained using pentane, hexane, and chloroform/methanol were designated as PSOP, PSOH, and PSOCM, respectively [42].

b. Oil Extraction By Cold Press

Raw or dried pumpkin seeds were cold-pressed three times using a continuous screw press at low temperature. To improve initial efficiency and prevent issues associated with cold pressing (which avoids thermal processing), the screw press head was preheated to 60-70 °C using a heating ring with automatic temperature control. This preheating step ensures smooth operation during startup. However, once optimal seed flow is established, the heating is discontinued, ensuring the extracted oil remains cold-pressed and unaffected by the preheating [42,43].

c. Oil Extraction By Soxhlet Apparatus

The ratio of seed weight to whole pumpkin fruit weight was determined. Seeds were then dried at 105°C for 24 hours, ground to pass through a 2mm sieve, and subjected to Soxhlet extraction with petroleum ether for 1.5 hours. The extracted oil was subsequently dried at 105°C for 2 hours.
Then the oil content was obtained from Equation (1):

$$\text{Percentage oil content} = W_3 - W_2 / W_1 \quad \ldots\ldots\ldots\ldots\ldots(1)$$

Where, W3 is weight of extraction cup + oil, g; W2 is weight of extraction cup, g; W1 is weight of original sample, g [44].

2.1.3. Nettle Leaf (Urtica dioica L.)

Nettle (Urtica dioica L.) is a plant found in temperate and tropical wastelands worldwide, with a long history in the European Pharmacopoeia [29].

The roots and leaves of this plant are used medicinally, as they contain active pharmacological compounds that influence cytological and physiological processes in the body[30].
Ethnobotanical studies conducted across Turkey have documented the utilization of Urtica dioica L. in traditional medicine for a diverse range of ailments. Reported applications include the treatment of malignancies, renal disorders, respiratory tract infections including cough, alopecia, dyspnea, paralysis, hypertension, gastrointestinal distress, rheumatism, fungal infections, osteoporosis, eczema and associated pruritus, hemorrhoids, gynecological conditions, nephrolithiasis, and digestive complaints[31].

Urtica dioica L. possesses a diverse array of bioactive compounds contributing to its medicinal properties. These include phytosterols, saponins, flavonoids, tannins, sterols, fatty acids, carotenoids, chlorophylls, proteins, amino acids, and vitamins. This rich phytochemical profile is associated with a wide range of reported pharmacological activities, including antioxidant, anti-inflammatory, antiulcer, anti-colitis, antiviral, anticancer, antibacterial, antimicrobial, antifungal, antiandrogenic, insecticide, immunomodulatory, hypocholesterolemic, hypoglycemic, cardiovascular, analgesic, natriuretic, hypotensive, and hepatoprotective effects, as well as potential benefits in rheumatoid arthritis[32].

A methanolic extract (10:1 extract ratio, 30% methanol) of the plant showed some ability to inhibit the 5α-reductase enzyme, but only when used in high concentrations (ED50 = 14.7 mg/ml) [33]. Importantly, this inhibitory effect was much weaker than that of finasteride, a known synthetic 5α-reductase inhibitor [34].

2.1.3.1. EXTRACTION OF NETTLE LEAF

Urtica dioica L. extract was prepared by macerating the plant material in separate solvents: water, ethanol, and hexane. Maceration was conducted at room temperature for 72 hours, using a 1:10 plant-to-solvent ratio for each solvent. Following filtration through filter paper, the resulting filtrates were concentrated and dried using a combination of vacuum evaporation and freeze-drying [45].

2.1.4. Green Tea (Camellia sinensis L.)

Camellia sinensis, the source of white, green, and black tea, is a globally significant plant. Tea, second only to water in consumption, is valued for both its enjoyable taste and health-promoting properties. Notably, green tea is often considered to offer greater health advantages compared to black tea [35].

Camellia sinensis is rich in polyphenols, a type of antioxidant. Green tea, with its particularly high polyphenol content (20-30%), stands out as a potent natural antioxidant source. Green tea's main catechins are: catechin (C), epicatechin (EC), epigallocatechin (EGC), epicatechin gallate (ECG), and epigallocatechin gallate (EGCG) [36].
According to previous research, all tea catechins have been described as powerful antioxidant agents in vitro and in vivo [37].
Multiple dietary components, such as polyunsaturated fatty acids, flavonoids, and tea catechin gallates, have demonstrated the ability to inhibit 5α-reductase both in laboratory (in vitro) and living organism (in vivo) studies [38].
Liao and Hiipakka's research revealed that tea epicatechin-3-gallate and epigallocatechin-3-gallate selectively inhibit steroid 5α-reductase isozymes. Specifically, they found that green tea catechins, (-) epigallocatechin-3-gallate and (-) epicatechin-3-gallate, are strong inhibitors of 5α-reductase type 1 (5-AR-1). These findings indicate that certain green tea gallates may influence androgen activity within target tissues [39].

Kim YY et al. studied the topical application of EGCG to address testosterone-induced hair loss in mice. Their findings revealed that testosterone-induced hair loss in mice is primarily due to hair follicle apoptosis, not changes in the androgen metabolic pathway. They also observed that topical EGCG reduced this testosterone-induced hair follicle apoptosis [40].

2.1.4.1. EXTRACTION OF GREEN TEA

A laboratory-scale extraction of green tea catechins was performed utilizing 100 g of non-commercial, desiccated green tea leaves. The source material underwent a three-hour maceration in 300 mL of 50% methanolic solution, maintained at a temperature of 50°C. Following the extraction period, the resulting solution was subjected to filtration to remove particulate matter. The solvent was subsequently removed via vacuum rotary evaporation, yielding a dry extract weighing 10.5 g. This extract was then reconstituted in 500 mL of sterile water [46].

2.2. HERB WITH VASODILATOR PROPERTY

2.2.1. Rosemary (Rosmarinus officinalis L.):

Rosmarinus officinalis L., commonly known as rosemary, is an ancient plant within the Lamiaceae family. This family's genus, Rosmarinus, encompasses several species beyond the familiar R. officinalis, such as R. tomentosus, R. laxiflorus, and R. lavandulaceus [47,48].

Rosemary has shown effectiveness in the treatment of androgenic alopecia, functioning similarly to minoxidil by improving scalp vascularity and stimulating hair follicle regeneration [49].

A 6-month, single-blind, randomized clinical trial involving 100 men aged 18-49 with androgenic alopecia (AGA) compared the efficacy of topical rosemary oil and 2% minoxidil. Participants were evenly divided into two groups, each receiving one of the treatments. Both groups showed a statistically significant increase in hair count after six months ($P < 0.05$), and there was no significant difference in hair count improvement between the two groups ($P > 0.05$). However, a notable difference emerged in side effects: scalp itching was significantly more prevalent in the minoxidil group compared to the rosemary oil group ($P < 0.05$), suggesting that rosemary oil may provide comparable hair growth benefits with fewer adverse effects [50-52].

A mouse model study investigated the antiandrogenic effects of Rosmarinus officinalis leaf extract, comparing it to finasteride and minoxidil in the treatment of androgenic alopecia. The study focused on the inhibition of testosterone 5-alpha-reductase, a key enzyme in this condition. Results showed that Rosmarinus officinalis extract exhibited potent 5-alpha-reductase inhibition, achieving 82.4% and 94.6% inhibition at concentrations of 200 mg/mL and 500 mg/mL, respectively. This was comparable to finasteride (250 nM), which showed 81.9% inhibition ($P < 0.01$). Furthermore, the extract was found to inhibit dihydrotestosterone (DHT) binding to androgen receptors. Further analysis identified 12-methoxycarnosic acid as the primary active inhibitory component [50].

Biological Source	Family	Common Name	Part used	Chem. Const.	Action	Ref.
Serenoa repens	Arecaceae	Saw Palmetto	Berries	Steroidal saponins, fatty acids, phytosterols, volatile oil, resins and tannins.	DHT blocker	[13-16]
Urtica dioica	Urticaceae	Stinging nettle	Roots	Vit. K, A & C and minerals	DHT blocker	[29-34]
Camellia sinensis	Theaceae	Tea	Leaves	epicatechins, caffeine, & other tannins	5-α reductase inhibitor	[35-40]
Cucurbita pepo	Cucurbitaceae	Pumpkin Seed	Seed	protein , alpha-tocopherols, carbohydrates , oleic acid , linoleic acid.	DHT blocker	[18-28]
Rosmarinus officinalis L.	Lamiaceae	Rosemary	Leaves	1,8-cineole (eucalyptol), alpha-pinene, camphor, and borneol	Vasodilator	[47-52]

Herbs used in Androgenic Alopecia

3. CONCLUSION

This review highlights the potential of several herbal extracts, including saw palmetto, pumpkin seed, green tea, and rosemary, as sources of DHT-blocking compounds for the treatment of androgenetic alopecia (a common cause of hair loss). These botanicals offer promising alternatives to conventional therapies, potentially with fewer adverse effects, and warrant further investigation for the development of effective herbal hair loss formulations.

REFERENCES

1. Mainkar AR., Jolly CI.(2001). Formulation of natural Shampoos. Int J Cosmet Sci,23,59-62.
2. Aghel N, Moghimipour B, Dana RA.(2007). Formulation of a herbal Shampoo using total saponins of Acanthophyllum squarrosum. Iran J Pharm Res,6,167-72.
3. Potluri A, Asma SS, Rallapally N, Durrivel S, Harish GA.(2013). Review on herbs used in anti-dandruff Shampoo and its evaluation parameters. Indo Am J Pharm Res,3,3266-78.
4. Schneider, M.R.; Schmidt-Ullrich, R.; Paus, R.(2009). The hair follicle as a dynamic miniorgan. Curr. Biol, 19, R132–R142.
5. Lepselter, J., & Elman, M. (2004). Biological and clinical aspects in laser hair removal. Journal of Dermatological Treatment, 15(2), 72–83.
6. Hernandez, I., Alam, M., Platt, C., Hardman, J., Smart, E., Poblet, E., et al. (2018). A technique for more precise distinction between catagen and telogen human hair follicles ex vivo. Journal of the American Academy of Dermatology, 79(3), 558–559.
7. Jänne, O. A., Palvimo, J. J., Kallio, P., & Mehto, M. (1993). Androgen Receptor and Mechanism of Androgen Action. Annals of Medicine, 25(1), 83–89.
8. Sawaya, M. E., Honig, L. S., Garland, L. D., & Hsia, S. L. (1988). Δ5-3β-Hydroxysteroid Dehydrogenase Activity in Sebaceous Glands of Scalp in Male-Pattern Baldness. Journal of Investigative Dermatology, 91(2), 101–105.
9. Rakel D (2012). Integrative Medicine E-Book. Elsevier Health Sciences. pp. 321–. ISBN 978-1-4557-2503-8.
10. Morrison MF (2000). Hormones, Gender and the Aging Brain: The Endocrine Basis of Geriatric Psychiatry. Cambridge University Press. pp. 17–. ISBN 978-1-139-42645-9.
11. Inui, S., & Itami, S. (2012). Androgen actions on the human hair follicle: perspectives. Experimental Dermatology, 22(3), 168–171.
12. Ceruti, J. M., Leirós, G. J., & Balañá, M. E. (2018). Androgens and androgen receptor action in skin and hair follicles. Molecular and Cellular Endocrinology, 465, 122–133.
13. Sultan C., Terraza A., Devillier C., Carilla E., Briley M., Loire C. and Descomps B.,(1984). Inhibition of androgen metabolism and binding by a liposterolic extract of Serenoa repens B in human foreskin fibroblastism. J Steroid Biochem , 20, 515-519.
14. Cristoni A., Di Pierro F. and Bombardelli E.(2000). Botanical derivatives for the prostate, Fitoterapia, 71 (Suppl 1), S21-S28.
15. Evron, E., Juhasz M., Babadjouni, A., & Mesinkovska, N. A. (2020). Natural Hair Supplement: Friend or Foe? Saw Palmetto, a Systematic Review in Alopecia. Skin Appendage Disorders, 6(6) , 329-337.
16. Wilt, T. J., Ishani, A., Stark, G., MacDonald, R., Lau, J., & Mulrow, C. (1998). Saw Palmetto Extracts for Treatment of Benign Prostatic Hyperplasia. JAMA, 280(18), 1604.
17. Aung, P. Z., Nararatwanchai, T., Pawcsuntorn, T., & Pandii, W. (2024). Efficacy and Safety of Topical Pure Saw Palmetto (Serenoa repens) extract Lotion in Androgenetic Alopecia. Procedia of Multidisciplinary Research, 2(10), 3.
18. Younis, Y. M. ., Ghirmay, S., & Al-Shihry, S. . (2000). African Cucurbita pepo L.: properties of seed and variability in fatty acid composition of seed oil. Phytochemistry, 54(1), 71–75.
19. Ryan, E., Galvin, K., O'Connor, T. P., Maguire, A. R., & O'Brien, N. M. (2007). Phytosterol, Squalene, Tocopherol Content and Fatty Acid Profile of Selected Seeds, Grains, and Legumes. Plant Foods for Human Nutrition, 62(3), 85–91.

20. Procida, G., Stancher, B., Cateni, F., & Zacchigna, M. (2012). Chemical composition and functional characterisation of commercial pumpkin seed oil. Journal of the Science of Food and Agriculture, 93(5), 1035–1041.
21. Paul, M., Sohag, M. S. U., Khan, A., Barman, R. K., Wahed, M. I. I., & Khan, M. R. I. (2020). Pumpkin (Cucurbita maxima) seeds protect against formaldehyde-induced major organ damages. Heliyon, 6(8), e04587.
22. Rouag, M., Berrouague, S., Djaber, N., Khaldi, T., Boumendjel, M., Taibi, F., … Messarah, M. (2020). Pumpkin seed oil alleviates oxidative stress and liver damage induced by sodium nitrate in adult rats: biochemical and histological approach. African Health Sciences, 20(1), 413–425.
23. Bardaa, S., Turki, M., Ben Khedir, S., Mzid, M., Rebai, T., Ayadi, F., & Sahnoun, Z. (2020). The Effect of Prickly Pear, Pumpkin, and Linseed Oils on Biological Mediators of Acute Inflammation and Oxidative Stress Markers. BioMed Research International, 2020, 1–11 .
24. Gossell-Williams, M., Davis, A., & O'Connor, N. (2006). Inhibition of Testosterone-Induced Hyperplasia of the Prostate of Sprague-Dawley Rats by Pumpkin Seed Oil. Journal of Medicinal Food, 9(2), 284–286.
25. CARBIN, B.-E., LARSSON, B., & LINDAHL, O. (1990). Treatment of Benign Prostatic Hyperplasia with Phytosterols. British Journal of Urology, 66(6), 639–641.
26. Cho, Y. H., Lee, S. Y., Jeong, D. W., Choi, E. J., Kim, et. al (2014). Effect of Pumpkin Seed Oil on Hair Growth in Men with Androgenetic Alopecia: A Randomized, Double-Blind, Placebo-Controlled Trial. Evidence-Based Complementary and Alternative Medicine, 2014, 1–7.
27. Ibrahim, I. M., Hasan, M. S., Elsabaa, K. I., & Elsaie, M. L. (2021). Pumpkin seed oil vs. minoxidil 5% topical foam for the treatment of female pattern hair loss: A randomized comparative trial. Journal of Cosmetic Dermatology, 20(9), 2867–2873.
28. Hajhashemi V., Rajabi R., Mardani M. (2019). Beneficial Effects Pumpkin Seed as a Topical Hair Growth Promoting Agent in a Mice Model. Avicenna J Phytomed;9(6):499–504.
29. Asgarpanah, J. ve Mohajerani, R. (2012). Phytochemistry and pharmacologic properties of Urtica dioica L. Journal of Medicinal Plants Research, 6(46), 5714-5719.
30. Casarett LJ, Klaassen CD, Doull J(2008). Casarett and Doull's toxicology : the basic science of poisons. McGraw-Hill Professional, 1104.
31. Şimşek, I., Aytiken, F., Yesilada, E. & Yıldırımlı, S., 2004. An ethnobotanical study of the Beypazarı, Ayas, and Gudul district towns of Ankara province (Turkey). Economic Botany, 58: 705-720.
32. Joshi, B. C., Mukhija, M., & Kalia, A. N. (2014). Pharmacognostical review of Urtica dioica L. International Journal of Green Pharmacy (IJGP), 8(4).
33. Hartmann, R.W., Mark, M., Soldati, F., 1996. Inhibition of 5 a-reductase and aromatase by PHL-00801 (Prostatonins), a combination of PY 102 (Pygeum africanum) and UR 102 (Urtica dioica) extracts. Phytomedicine 3, 121–128.
34. Koch, E., Biber, A., 1994. Pharmakologische Wirkungen von Sabal- und Urtikaextrakten als Grundlage fu¨r eine rationale medikamento¨se Therapie der benignen Prostatahyperplasie. Urologe B 34, 90–95.
35. Sinija, V. R., & Mishra, H. N. (2008). Green tea: Health benefits. Journal of Nutritional & Environmental Medicine, 17(4), 232–242.
36. F. Akbarnejad.(2023). The Role of Green Tea (Camellia sinensis) in the Management of Androgenetic Alopecia (AGA): A Review. International Journal of Multidisciplinary Research and Growth Evaluation, 4(5), 308-316.

37. Koch W. (2019). Dietary polyphenols—Important non-nutrients in the prevention of chronic noncommunicable diseases. A systematic review. Nutrients, 11(5) ,1039.
38. . Hiipakka RA, Liao S.(1998). Molecular mechanism of androgen action. Trends in Endocrinology & Metabolism. 9(8),317-24.
39. Liao, S. S., & Hiipakka, R. A. (1995). Selective-Inhibition of Steroid 5 α-Reductase Isozymes by Tea Epicatechin-3-Gallate and Epigallocatechin-3-Gallate. Biochemical and Biophysical Research Communications, 214(3), 833–838.
40. Kim, Y. Y., up No, S., Kim, M. H., Kim, H. S., Kang, H., Kim, H. O., & Park, Y. M. (2011). Effects of topical application of EGCG on testosterone-induced hair loss in a mouse model. Experimental Dermatology, 20(12), 1015–1017.
41. Anderson, M. L. (2005). A Preliminary Investigation of the Enzymatic Inhibition of 5α-Reductase and Growth of Prostatic Carcinoma Cell Line LNCap-FGC by Natural Astaxanthin and Saw Palmetto Lipid ExtractIn Vitro. Journal of Herbal Pharmacotherapy, 5(1), 17–26.
42. REZIG, L., CHOUAIBI, M., OJEDA-AMADOR, R. M., GOMEZ-ALONSO, S., SALVADOR, M. D., FREGAPANE, G., & HAMDI, S. (2018). Cucurbita maxima Pumpkin Seed Oil: from the Chemical Properties to the Different Extracting Techniques. Notulae Botanicae Horti Agrobotanici Cluj-Napoca, 46(2), 630.
43. REZIG, L., CHOUAIBI, M., OJEDA-AMADOR, R. M., GOMEZ-ALONSO, S., SALVADOR, M. D., FREGAPANE, G., & HAMDI, S. (2018). Cucurbita maxima Pumpkin Seed Oil: from the Chemical Properties to the Different Extracting Techniques. Notulae Botanicae Horti Agrobotanici Cluj-Napoca, 46(2), 630.
44. Kukeera T., Banadda N., Tumutegyereize P., Kiggundu N., Asuman R. (2015). Extraction, quantification and characterization of oil from pumpkin seeds[J]. International Journal of Agricultural and Biological Engineering, 2015, 8(1), 98-102.
45. Myagmar, K., Lkhagvasuren, E., & Semchin, M. (2018). Hair Growth Promoting Effect of Urticadioica L. Central Asian Journal of Medical Sciences, 4(3), 187–193.
46. Esfandiari A., Kelly AP.(2005). The effects of tea polyphenolic compounds on hair loss among rodents. J Natl Med Assoc. Aug, 97(8) ,1165-9.
47. Pappachan F, et al. Rosmarinus Officinalis. In: Rosmarinus Officinalis - an Overview. ScienceDirect Topics. Available from: www.sciencedirect.com/topics/agricultural-and-biological-sciences/rosmarinus-officinalis. Accessed October 29, 2024.
48. Ribeiro-Santos, R., Carvalho-Costa, Sanches-Silva, A. et al. (2015). A novel insight on an ancient aromatic plant: The rosemary (Rosmarinus officinalis L.). Trends in Food Science & Technology, 45(2), 355–368.
49. Hosking, A.-M., Juhasz, M., & Atanaskova Mesinkovska, N. (2018). Complementary and Alternative Treatments for Alopecia: A Comprehensive Review. Skin Appendage Disorders, 1–18.
50. Panahi Y, Taghizadeh M, Marzony E, Sahebkar A.(2015). Rosemary oil vs minoxidil 2% for the treatment of androgenetic alopecia: a randomized comparative trial. Skinmed. 13(1), 15–21.
51. Ozmen € _ I, C¸alis¸kan E, Arca E, Acikgoz G, Koc E.(2015). Efficacy of aromatherapy in the treatment of localized alopecia areata: a double-blind placebo-controlled study. Gulhane Med J. 57(3), 233–236.
52. Hay IC, Jamieson M, Omerod AD.(1998). Randomized trial of aromatherapy. Successful treatment for alopecia areata. Arch Dermatol. 134(11), 1349–1352.