

Phytotherapy in Androgenetic Alopecia: A Review

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Abstract

Androgenetic alopecia (AGA) is largely mediated by dihydrotestosterone (DHT). Conventional 5-alpha-reductase inhibitors are effective but limited by adverse effects, prompting interest in phytotherapy. This review summarizes evidence on natural DHT blockers including Saw palmetto, *Pygeum Africanum*, Beta-sitosterol, Nettle root, Quercetin, Pumpkin seed oil, Green tea (EGCG), Licorice root, Flaxseed, Curcumin, Astaxanthin, Resveratrol, L-Carnitine, Spearmint, and Reishi mushroom. These agents act via 5AR inhibition, androgen receptor modulation, anti-inflammatory, and antioxidant pathways. Clinical data are strongest for Saw palmetto, pumpkin seed oil, and EGCG, while others remain promising but under-investigated. Most are well tolerated, though Licorice and Flaxseed require caution. Natural DHT blockers represent a potential adjunct or alternative to pharmaceuticals, but standardized formulations and larger clinical trials are needed.

Introduction

Androgenetic alopecia (AGA) is a prevalent form of hair loss in both men and women, largely mediated by dihydrotestosterone (DHT) acting on follicular androgen receptors. Current therapeutic approaches, such as finasteride and dutasteride, inhibit 5-alpha-reductase (5AR) but are limited by significant sexual, psychological, and systemic side effects. This has led to growing interest in natural DHT blockers that may provide multifactorial benefits—addressing inflammation, oxidative stress, and circulation—while offering improved tolerability and suitability for both genders. The aim of this review is to synthesize the available evidence on natural compounds with anti-DHT activity and their potential applications in trichology.

This review was conducted through a targeted literature search on PubMed, Scopus, and Google Scholar, using the keywords: “natural DHT blockers,” “androgenetic alopecia,” “5-alpha-reductase inhibition,” “herbal antiandrogens,” and “phytotherapy for hair loss.” Studies were included if they addressed (1) plant- or nutrient-derived agents with documented effects on DHT pathways, (2) mechanistic or clinical outcomes relevant to hair health, and (3) reported dosages or safety considerations. Studies without mechanistic clarity or peer-reviewed evidence were excluded.

Pygeum africanum

Pygeum africanum, extracted from the bark of the African plum tree, is a plant-based remedy that shows promise for treating androgenetic alopecia, also known as male and female pattern baldness. Androgenetic alopecia is often caused by the hormone dihydrotestosterone (DHT), which is produced when testosterone is converted by the enzyme 5-alpha reductase (5AR). High levels of DHT can lead to the miniaturization of hair follicles, shortening the hair growth cycle and ultimately causing hair thinning and loss.

The key mechanism by which *Pygeum* may help with hair loss is its ability to inhibit the 5-alpha reductase enzyme and block androgen receptors, thus reducing the effects of DHT on hair follicles¹. While it has been extensively studied for benign prostatic hyperplasia (BPH) due to this same mechanism, research is increasingly focusing on its application for hair loss.

Some studies have explored the efficacy of *Pygeum africanum*, often in combination with other herbal extracts like *Saw palmetto*. A double-blind, placebo-controlled clinical trial involving post-menopausal women with androgenetic alopecia showed that a dietary supplement containing a co-extract of *Serenoa repens* (Saw palmetto) and *Pygeum africanum* significantly increased the percentage of hair in the anagen (growing) phase and decreased the percentage of hair in the telogen (resting) phase after 16 weeks of treatment². Much of the

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existing research on Pygeum for hair loss has used formulations that combine it with other ingredients, making it challenging to isolate the specific effects of Pygeum alone. Pygeum has been associated with reduced fertility due to alterations in semen parameters.

Beta Sitosterol

Beta-Sitosterol is a plant-derived sterol structurally similar to cholesterol, commonly found in saw palmetto, pygeum, and many vegetables, nuts, and seeds. Its role in hair loss management is linked to its dual mechanism of action: it can compete with dihydrotestosterone (DHT) for binding sites on androgen receptors, thereby reducing androgenic signaling in scalp hair follicles, and it exerts a mild inhibitory effect on the enzyme 5-alpha-reductase (5AR), lowering the conversion of testosterone to DHT³. These effects are mechanistically important in androgenetic alopecia (AGA), a condition in which DHT drives follicular miniaturization. Clinical evidence from studies in benign prostatic hyperplasia (BPH) supports beta-sitosterol's activity in androgen-dependent tissues, showing improvements in urinary flow and prostate volume reduction, outcomes that indirectly validate its anti-DHT potential³. Beyond androgen modulation, beta-sitosterol also interferes with intestinal cholesterol absorption, improving lipid profiles and offering cardiovascular benefits, although high doses may reduce absorption of fat-soluble vitamins (A, D, E, and K)⁴. In the context of hair loss, beta-sitosterol is often studied alone or in combination with saw palmetto and pygeum extracts, with some trials reporting increased hair density and reduced shedding in men with AGA. Typical doses for androgen modulation and hair health range from 60 to 130 mg/day, whereas higher intakes approaching 2 g/day are mainly used for cholesterol lowering. Overall, beta-sitosterol represents a promising natural adjunct for hair loss therapy, with a favorable safety profile, though larger, standardized clinical trials specifically in trichology are still needed to confirm its efficacy and long-term safety.

Nettle root

Nettle root (*Urtica dioica radix*) is a botanical extract with multifaceted effects on androgen metabolism and systemic health, making it a promising adjunct in the management of androgenetic alopecia (AGA). Its anti-androgenic activity is mediated through several mechanisms: it reduces dihydrotestosterone (DHT) activity by blocking receptor binding at the follicular level⁵ and exerts a mild inhibitory effect on the 5-alpha-reductase (5AR) enzyme, thereby decreasing the conversion of testosterone to DHT. Additionally, nettle root contains lignans and other phytochemicals that bind to sex hormone-binding globulin (SHBG)⁶, altering the proportion of free, bioavailable testosterone, which indirectly influences the pool of DHT available to interact with hair follicles.

Clinical studies, many conducted in the context of benign prostatic hyperplasia (BPH), demonstrate that nettle root can reduce prostate volume, improve lower urinary tract symptoms, and lower androgenic activity in prostate tissue—evidence that reinforces its role as a natural anti-DHT agent⁷⁻⁹. Beyond androgen modulation, nettle root exhibits anti-inflammatory and antioxidant properties, which may contribute to a healthier scalp microenvironment, reduce perifollicular inflammation, and support hair follicle survival¹⁰. It also shows mild hypoglycemic and hypotensive effects, making it potentially beneficial in metabolic health contexts, although caution is warranted in patients already on glucose- or blood pressure-lowering medications.

The typical dosage for standardized nettle root extract ranges from 300–600 mg/day, often delivered in capsules or as part of combination phytotherapeutic formulations with saw palmetto, Pygeum, or beta-sitosterol. Side effects are generally minimal, with gastrointestinal discomfort being the most reported. While large-scale randomized controlled trials in AGA are still lacking, the mechanistic plausibility, coupled with supportive data from prostate health studies, positions nettle root as a safe and well-tolerated natural option for individuals seeking alternatives or complements to pharmaceutical 5AR inhibitors.

Saw palmetto

Saw palmetto (*Serenoa repens*) is one of the most extensively studied botanical agents in the management of androgen-dependent conditions and is particularly relevant to androgenetic alopecia (AGA). Its primary mechanism of action involves the inhibition of both type I and type II isoforms of the 5-alpha-reductase (5AR), thereby reducing the conversion of testosterone to dihydrotestosterone (DHT), the key androgen implicated in hair follicle miniaturization¹¹. Unlike pharmaceutical inhibitors such as finasteride and dutasteride, which selectively block type II or both isoforms more potently, saw palmetto offers a milder, plant-

derived inhibition that is often better tolerated and associated with fewer sexual or systemic side effects¹¹. Additionally, saw palmetto appears to interfere with DHT binding at the androgen receptor level, further attenuating androgenic signaling within hair follicle cells.

Clinical evidence supports its relevance in both urology and dermatology. Randomized controlled trials in men with benign prostatic hyperplasia (BPH) have demonstrated improvements in urinary symptoms, reductions in prostate volume, and lower serum DHT activity, lending credibility to its anti-androgenic potential^{12–16}. Importantly, several trials and open-label studies have extended these findings to trichology, with reports of increased hair density, reduced shedding, and improved hair quality in patients with AGA, both as monotherapy and in combination with topical minoxidil^{17,18}. While results vary between studies due to differences in extract standardization and sample sizes, the overall trend indicates a modest but clinically meaningful benefit.

The standardized lipophilic extract of saw palmetto, containing 85–95% free fatty acids and sterols, is the preparation most frequently used in clinical research¹⁵. The typical dosage for hair loss and prostate health is 320 mg/day, usually taken orally in a single or divided dose¹⁵. Topical formulations (lotions or shampoos) have also been explored, though oral administration remains the most studied route. Saw palmetto may modestly reduce prostate-specific antigen (PSA) levels, which is relevant when interpreting PSA testing in men undergoing prostate cancer screening¹⁵. In addition, it demonstrates mild antiplatelet activity, which means caution is advisable for individuals using anticoagulants or preparing for surgery.

Beyond its androgen-modulating effects, saw palmetto exhibits anti-inflammatory, antioxidant, and vasodilatory properties that may further support scalp and follicular health. It is generally well tolerated, with gastrointestinal upset being the most common side effect, and it is regarded as safe for long-term use in most adults. Taken together, saw palmetto offers a multifactorial natural approach to hair loss management, making it a valuable adjunct or alternative to pharmaceutical 5AR inhibitors, particularly for patients seeking gentler, more holistic treatment options.

Quercetin

Quercetin is a naturally occurring flavonoid widely distributed in fruits, vegetables, and medicinal plants, and it has attracted attention in trichology due to its unique combination of antioxidant, anti-inflammatory, and anti-androgenic properties. Mechanistically, quercetin has been shown to downregulate the expression of 5-alpha-reductase (5AR), thereby reducing the enzymatic conversion of testosterone into dihydrotestosterone (DHT), a central driver of androgenetic alopecia (AGA)¹⁹. In cell culture studies, quercetin also inhibits DHT-induced proliferation of prostate and skin cells, suggesting that it can blunt androgen-mediated activity in tissues beyond the prostate, including hair follicles¹⁹. This effect is complemented by its ability to modulate androgen receptor signaling indirectly, further diminishing the pro-miniaturization influence of DHT on susceptible follicles.

Beyond direct hormonal modulation, quercetin exerts systemic effects that contribute to scalp and follicular health. As a potent antioxidant, it scavenges reactive oxygen species and protects follicular keratinocytes from oxidative stress, a factor increasingly recognized in the pathophysiology of AGA and telogen effluvium. Its anti-inflammatory activity helps to suppress pro-inflammatory cytokines such as TNF-alpha and IL-6, which are often elevated in perifollicular microinflammation. These combined effects may create a more favorable scalp environment, preserving follicular stem cell niches and supporting normal hair cycling.

Quercetin also impacts vascular and metabolic pathways that can indirectly influence hair growth. It improves microcirculation by enhancing endothelial function and vasodilation, which supports greater delivery of oxygen and nutrients to hair follicles. In addition, quercetin enhances insulin receptor activity and glucose uptake, contributing to improved metabolic balance. Since insulin resistance and metabolic syndrome have been associated with accelerated hair loss, this property may further protect against AGA progression. Its ability to reduce carbohydrate absorption in the intestine may also play a role in glycemic control and systemic inflammation, indirectly benefiting scalp physiology.

Clinical use of quercetin in hair loss is still emerging, but its broad mechanistic profile and supporting data from prostate and dermatologic research provide a compelling rationale for its integration into trichological protocols. Typical supplemental dosages range from 500 to 1000 mg/day, usually given orally in divided doses, though higher doses are sometimes used for systemic anti-inflammatory effects. Quercetin is generally well tolerated, but mild gastrointestinal discomfort and headaches can occur, particularly at higher intakes. Synergistic

benefits may be achieved when quercetin is combined with other natural DHT blockers such as saw palmetto, pygeum, or green tea catechins, as well as antioxidants like resveratrol or curcumin.

Pumpkin seed Oil

Pumpkin seed oil (*Cucurbita pepo*) has emerged as a notable natural therapy for androgenetic alopecia (AGA) due to its multifactorial effects on hormonal, inflammatory, and nutritional pathways relevant to hair follicle health. One of its primary mechanisms is the inhibition of 5-alpha-reductase (5AR), the enzyme responsible for converting testosterone into dihydrotestosterone (DHT), the key androgen implicated in hair follicle miniaturization²⁰. By moderating this pathway, pumpkin seed oil reduces excessive androgenic signaling within scalp follicles. In addition, the oil contains phytosterols, particularly beta-sitosterol, which can further contribute to androgen receptor modulation and support a more balanced hormonal environment.

Pumpkin seed oil is also rich in anti-inflammatory compounds such as tocopherols and polyunsaturated fatty acids, which help to reduce scalp inflammation, a factor increasingly recognized in the progression of AGA. By lowering the levels of inflammatory mediators and improving the local immune response, it creates a healthier scalp microenvironment conducive to follicular regeneration. Its high antioxidant capacity further protects follicular keratinocytes from oxidative stress, preserving stem cell activity and prolonging the anagen (growth) phase of the hair cycle.

Clinical evidence adds significant weight to its role in hair loss management. A landmark 2014 randomized, double-blind, placebo-controlled trial involving men with AGA demonstrated that pumpkin seed oil supplementation resulted in a significant increase in hair count compared to placebo after 24 weeks of use²⁰. Participants receiving the oil showed improved hair density and overall patient satisfaction, providing one of the strongest clinical validations among natural DHT-blocking agents. Additional animal studies have confirmed these findings, showing that pumpkin seed oil can reverse testosterone-induced hair loss and stimulate new follicular activity²¹⁻²².

Nutritionally, pumpkin seed oil is an excellent source of zinc, magnesium, iron, and unsaturated fatty acids, all of which play critical roles in maintaining scalp and hair follicle health. Zinc, in particular, is essential for keratin production and has its own mild inhibitory effect on 5AR, while magnesium supports energy metabolism within follicular cells. These nutritional contributions, combined with its phytochemical profile, make pumpkin seed oil both a direct and indirect promoter of hair growth.

The typical supplemental dosage ranges from 400 to 1000 mg per day, usually delivered as softgel capsules, though higher doses have been studied for prostate health. The oil is generally well tolerated, with occasional reports of mild gastrointestinal discomfort. Due to its fatty acid composition, it may also support cardiovascular and metabolic health, offering additional systemic benefits beyond hair restoration.

Green tea (EGCG)

Green tea (*Camellia sinensis*) extract, particularly its major catechin epigallocatechin-3-gallate (EGCG), has become a subject of significant interest in hair loss research due to its combined anti-androgenic, antioxidant, and anti-inflammatory effects. Mechanistically, EGCG is a potent inhibitor of 5-alpha-reductase (5AR), the enzyme responsible for converting testosterone into dihydrotestosterone (DHT)^{23,24}. By lowering local DHT activity, it directly addresses the key hormonal pathway involved in androgenetic alopecia (AGA)²⁵⁻²⁸. Beyond enzymatic inhibition, EGCG also interferes with DHT signaling within follicular cells, reducing androgen receptor activation and suppressing downstream gene expression that contributes to follicular miniaturization²⁵.

In vitro and animal studies have consistently shown that EGCG suppresses DHT-driven proliferation of prostate and skin cells, providing strong mechanistic evidence that is highly relevant to trichology^{29,30}. It also promotes anagen phase induction, with several reports indicating that EGCG can prolong hair follicle growth cycles and stimulate dermal papilla cell activity. These effects are not solely androgen-related—EGCG enhances vascular endothelial growth factor (VEGF) expression, thereby improving blood supply to follicles, and reduces apoptosis in hair matrix keratinocytes. Collectively, these mechanisms create a more favorable microenvironment for follicle survival and growth.

Another key contribution of EGCG lies in its antioxidant and anti-inflammatory properties. It neutralizes free radicals and inhibits NF-κB-mediated inflammatory signaling, both of

which play roles in perifollicular microinflammation observed in AGA and telogen effluvium³¹. By reducing oxidative stress, EGCG helps protect the follicular stem cell niche, while its anti-inflammatory action lowers the expression of pro-inflammatory cytokines such as TNF-alpha and IL-1beta. This dual role enhances scalp health and may slow the progression of hair thinning.

Green tea extracts are typically standardized to contain high concentrations of EGCG, with effective supplemental doses ranging from 200 to 400 mg/day. Some studies suggest higher intakes may be beneficial, but tolerability and safety must be considered, as EGCG at elevated doses can increase the risk of liver enzyme elevation. Common side effects include caffeine-related issues such as jitteriness, insomnia, or gastrointestinal discomfort, although decaffeinated extracts are widely available. EGCG may also reduce iron absorption, an important consideration in individuals—especially premenopausal women—at risk for iron deficiency-related hair loss.

In clinical practice, green tea extract is often used synergistically with other natural DHT blockers such as saw palmetto, pygeum, or pumpkin seed oil, with anecdotal reports of improved outcomes compared to monotherapy. Its broad safety profile, combined with systemic benefits such as improved metabolic health, cardiovascular protection, and weight management support, make it attractive not only as a hair health agent but also as a holistic supplement for general well-being.

Overall, EGCG represents a multifactorial natural compound with strong mechanistic plausibility in trichology. By targeting DHT, improving circulation, reducing inflammation, and protecting against oxidative stress, it offers a comprehensive approach to supporting follicular longevity. While large-scale randomized controlled trials specifically in AGA are still needed, the convergence of preclinical data and supportive clinical experience positions green tea extract as one of the most promising plant-derived agents in integrative hair loss therapy.

Licorice Root

Licorice root (*Glycyrrhiza glabra*) has been used for centuries in traditional medicine and more recently studied for its role in hormonal modulation and potential benefits in hair loss. Its active compounds, particularly flavonoids and glycyrrhizin, exert inhibitory effects on 5-alpha-reductase (5AR), thereby reducing the enzymatic conversion of testosterone into dihydrotestosterone (DHT), the androgen most strongly implicated in follicular miniaturization and androgenetic alopecia (AGA)³². In addition, licorice has been shown to suppress androgen synthesis at the adrenal and testicular level, leading to reduced circulating testosterone and subsequently lower DHT production^{33,34}. This dual action—direct enzymatic inhibition and decreased substrate availability—suggests a mechanistic basis for its potential role as a natural anti-androgen in trichology.

Preclinical studies have demonstrated that licorice-derived flavonoids can downregulate expression of steroidogenic enzymes and attenuate androgen receptor signaling, both of which are relevant to the pathophysiology of hair loss. In dermatology, licorice extract is also valued for its anti-inflammatory and antioxidant properties, which may help reduce perifollicular inflammation and oxidative stress, two contributing factors to hair follicle damage and cycling disruption. These additional properties make licorice not only an anti-androgenic but also a scalp-supportive agent.

However, licorice root also carries important systemic hormonal effects. Glycyrrhizin inhibits the enzyme 11beta-hydroxysteroid dehydrogenase type 2, which normally converts active cortisol into inactive cortisone. As a result, excessive licorice intake can lead to elevated cortisol levels, producing a state known as “pseudohyperaldosteronism.” Clinically, this manifests as sodium retention, hypertension, fluid accumulation, and hypokalemia (low potassium levels)³²⁻³⁴. Long-term use can also lower serum testosterone, particularly in men, potentially leading to decreased libido, erectile difficulties, or reduced fertility³²⁻³⁴. While these effects may partly explain its anti-androgenic capacity, they also highlight the risks of high or chronic consumption.

Licorice root extracts are typically standardized for glycyrrhizin content, and doses vary widely depending on preparation. For systemic effects, 200–600 mg/day of extract is common, but in trichology, it is more often used as part of a combination rather than as a standalone oral supplement. Topical concentrations are variable but generally regarded as safe. To minimize risks, deglycyrrhizinated licorice (DGL) extracts—where the glycyrrhizin is removed—are sometimes recommended, as they retain many of the anti-inflammatory and antioxidant properties without the same risk of hypertension and electrolyte imbalance.

Flaxseed

Flaxseed lignans reduce 5AR activity and modulate hormone metabolism. Supplementation reduces DHT in men¹⁹. Dosage: 300–600 mg/day. Estrogen-like activity requires caution in hormone-sensitive cancers.

Curcumin

Curcumin modulates androgen receptor activity and suppresses 5AR gene expression. Reduces prostate weight in animal models³⁵. Dosage: 500–1000 mg/day. Risks include increased bleeding and reduced iron absorption.

Astaxanthin

Astaxanthin is a carotenoid antioxidant that inhibits testosterone conversion to DHT. Animal studies suggest synergistic effects with saw palmetto³⁶. Dosage: 2–8 mg/day. High doses may cause reversible skin pigmentation.

Resveratrol

Resveratrol is an antioxidant phytoestrogen that suppresses androgen receptor expression and 5AR activity^{37–41}. Inhibits aromatase and may reduce gynecomastia. Dosage: 50–250 mg/day. May reduce iron absorption.

L-Carnitine

L-Carnitine increases mitochondrial energy in hair follicles, protecting against DHT-induced apoptosis⁴². Stimulates hair shaft elongation⁴³. Dosage: 500–2000 mg/day orally or 2–4% topical solution. Side effects include possible hypothyroidism worsening.

Spearmint

Spearmint reduces free testosterone and indirectly decreases DHT. Clinical trials show reduction in hirsutism in women^{44,45}. Dosage: 300–900 mg/day.

Reishi Mushroom

Reishi Mushroom is a strong 5AR inhibitor in vitro. Most potent among medicinal mushrooms tested⁴⁶. Standardized extracts (300–1000 mg/day) contain polysaccharides and triterpenes. May mildly lower blood pressure.



Figure 1: A- *Pygeum africanum*, B- Nettle Root, C- Saw Palmetto, D- Pumpkin Seed Oil, E- Green Tea, F- Licorice, G- Flaxseed, H- Curcumin, I- Reishi Mushroom

Discussion and Conclusion

Natural DHT blockers offer a broad spectrum of mechanisms, including 5AR inhibition, androgen receptor modulation, and antioxidant or anti-inflammatory actions. Saw palmetto, pumpkin seed oil, and green tea have the strongest evidence in AGA, while others such as reishi mushroom, pygeum, and quercetin remain promising but under-researched in trichology. Safety varies by compound: most are well tolerated, though licorice root and flaxseed require caution in specific populations.

Natural DHT blockers represent a viable adjunct or alternative to pharmaceutical inhibitors, especially for patients seeking safer long-term options. Limitations of current research include small study sizes, variability in extract standardization, and limited long-term data. Future studies should emphasize standardized formulations, combination approaches, and rigorous randomized controlled trials.

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