

A REVIEW ON ALOPECIA: ETIOLOGY, CONVENTIONAL THERAPIES, AND HERBAL ALTERNATIVES

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Abstract: *Background:* Alopecia, a prevalent dermatological disorder characterized by partial or complete hair loss, significantly impacts patients' psychological and social well-being. Alopecia areata (AA), an autoimmune condition, represents one of the most common forms and is influenced by genetic predisposition, environmental triggers, and lifestyle factors. Conventional therapies such as corticosteroids, immunosuppressants, and Janus kinase (JAK) inhibitors may stimulate hair regrowth but are often limited by relapse, cost, or adverse effects. In recent years, increasing interest has been directed toward herbal and traditional medicine for alopecia management. Numerous medicinal plants, including Bhringraj (*Eclipta alba*), Amla (*Phyllanthus emblica*), Neem (*Azadirachta indica*), Aloe vera, and Rosemary (*Rosmarinus officinalis*), possess bioactive phytoconstituents such as flavonoids, terpenes, alkaloids, and fatty acids, which exhibit antioxidant, anti-inflammatory, immunomodulatory, and follicle-stimulating properties. These agents support scalp health, prolong the anagen phase, and improve circulation, thereby promoting hair regrowth with minimal side effects compared to synthetic drugs. This review highlights the causes, risk factors, clinical diagnosis, and treatment strategies of alopecia, with a special focus on herbal remedies and their potential role as safe and effective alternatives for long-term management.

Keywords: Alopecia areata; Hair loss; Herbal medicine; Phytoconstituents; Scalp disorders; Autoimmune disease; Traditional medicine; Hair regrowth; Medicinal plants; Complementary therapy.

INTRODUCTION

Scalp alopecia's are a group of dermatologic illnesses that encompass a wide range of different conditions. They are among the most prevalent dermatologic conditions. A comprehensive physical examination and a detailed review of the patient's history are typically sufficient to confirm the right diagnosis. The need for a scalp biopsy may be essential in some circumstances, such as those of cicatricial alopecia. Histopathologic traits, on the other hand, are not necessarily indicative of a diagnosis. As a result, it is necessary to develop new diagnostic procedures. Scalp dermatoscopy is a potential new technique for diagnosing scalp and hair diseases that may be difficult to diagnose otherwise. A large number of publications have been published about the video dermatoscopic aspects of alopecias in various stages^[1].

Alopecia Areata (AA) is a frequent recurrent dermatological autoimmune illness that causes patchy regions of hair loss on the scalp and/or body. It can afflict people of any age or skin type, and it affects both men and women^[2]. In the United States, the cumulative lifetime incidence of AA is estimated to be roughly 2 percent of the population^[3]. Among contrast, the worldwide incidence of hepatitis C varies from 0.57 percent to 3.8 percent in individuals who present to a hospital setting^[4-7]. The manner in which the illness manifests itself varies from one sufferer to the next, ranging from hair loss in distinct, well-circumscribed circular or oval spots on the scalp or body to complete

hair loss on the entire scalp (Alopecia Totalis) and to complete hair loss on the entire body (Alopecia Universalis)^[8].

Causes and Risk Factors

Autoimmunity and genetics: AA is a genetically complex autoimmune disease. Numerous genes linked to the immune system have been associated with a higher risk of developing the condition. It also shares genetic risk factors with other autoimmune conditions, such as vitiligo, lupus erythematosus, rheumatoid arthritis, thyroid disease, and atopic dermatitis^[9].

Environmental factors: While the precise triggers are not fully understood, environmental factors like emotional stress, illness, viral infections, and vaccines may trigger AA in genetically susceptible individuals^[10].

Lifestyle: Some studies suggest that smoking and obesity may contribute to the onset and progression of the disease^[11].

Symptoms

Hair loss: Patches of hair loss are the most common symptom. They can appear suddenly on the scalp, beard, eyebrows, or other body parts.

Exclamation mark hairs: These are short hairs that are narrower at the base and wider at the top. They are a classic sign of active disease and are often seen at the edges of bald patches.

Nail changes: Nail pitting (tiny dents), trachyonychia (rough texture), and other abnormalities can occur in a significant percentage of patients^[10].

Other sensations: Some people report tingling, itching, or a burning sensation on affected skin just before hair loss occurs.

Types of Alopecia Areata

Alopecia areata is an autoimmune condition that causes hair loss in several distinct patterns, depending on the type. The most common types range from small, patchy areas of hair loss to complete baldness of the scalp or entire body^[12].

Main types of alopecia areata

Patchy alopecia areata: The most common form, this involves coin-sized, round, or oval patches of hair loss on the scalp or other parts of the body, such as the beard area^[13].

Alopecia totalis: This type results in the complete or near-complete loss of hair on the scalp. It is considered a more severe form of alopecia areata and may develop from the patchy type^[14].

Alopecia universalis: The rarest and most advanced form, alopecia universalis results in the complete or nearly complete loss of all hair on the scalp, face (including eyebrows and eyelashes), and the rest of the body. It may also progress from patchy alopecia areata^[14].

Less common variations

Ophiasis: This distinct pattern causes hair loss in a band-like shape along the sides and lower back of the scalp (occipital and temporal regions). This type can be more persistent and difficult to treat than other forms^[15].

Sisaipho: A rare variant with an inverse pattern to ophiasis, sisaipho (ophiasis spelled backward) involves hair loss across the top of the scalp while sparing the sides and back^[16].

Diffuse alopecia areata: Also known as alopecia areata incognita, this form causes sudden, generalized thinning or shedding of hair all over the scalp, rather than distinct patches^[17].

Alopecia barbae: This term specifically refers to alopecia areata that is limited to the beard area in men.

Nail alopecia areata: In some cases, alopecia areata can cause changes to the nails, such as pitting (small dents) or ridges. Nail abnormalities are more common in severe forms of the condition^[10].

Diagnosis

A dermatologist can typically diagnose AA through a physical exam and medical history. They may use a handheld magnifying device called a dermatoscope to examine the hair and scalp for characteristic signs like "yellow dots," "black dots," and exclamation point hairs. In unclear cases, a scalp biopsy or blood tests may be ordered to rule out other conditions^[18].

Clinical diagnosis

A dermatologist will examine the affected areas for the characteristic features of alopecia areata.

Hair loss pattern: Alopecia areata most commonly appears as sudden, well-defined, round, or oval-shaped patches of non-scarring hair loss on the scalp or other body areas.

"Exclamation point" hairs: During active hair loss, the dermatologist may observe unique broken hairs at the edges of bald patches that are narrow at the base and wider at the tip. These are a key diagnostic sign.

Nail changes: The doctor will examine your fingernails and toenails for abnormalities, as changes can occur in up to 30% of cases. These include tiny pits (stippling), ridges, or a rough, sandpaper-like texture (trachyonychia)^[19].

Hair pull test: This is a test to check for active hair shedding. The doctor gently pulls on a small group of hairs at the edge of a patch. If more than a few hairs come out, it indicates active disease^[20].

Specialized examinations

Dermoscopy: This procedure uses a handheld magnifying device called a dermatoscope to get a closer look at the hair follicles. It can reveal key signs of alopecia areata, such as yellow dots (indicating damaged follicles), black dots (broken hairs), and short, regrowing hairs^[21].

Scalp biopsy: If the clinical picture is unclear, a biopsy may be performed to rule out other conditions. A small skin sample is taken from the scalp and examined under a microscope. An acute biopsy will reveal a "swarm of bees" pattern, which is a dense cluster of immune cells attacking the hair follicle^[22].

Treatment

The treatment of alopecia areata (AA) is tailored to the severity and extent of hair loss and the patient's age. While there is currently no permanent cure, and hair regrowth can be unpredictable, a variety of treatments can stimulate hair growth and manage the condition.

Treatments for patchy alopecia areata

For limited, patchy AA, common treatments focus on targeting the immune attack on the hair follicles in specific areas

Corticosteroid injections: Considered the most effective treatment for patchy AA in adults, corticosteroids are injected directly into the bald spots. Hair regrowth can often be seen within 1 to 3 months, and injections are repeated every 4 to 6 weeks^[23-24].

Topical corticosteroids: For children or adults who prefer to avoid injections, potent topical corticosteroids can be applied directly to the affected areas. This is generally less effective than injections but has a milder side effect profile^[24-25].

Topical minoxidil: Applied to bald spots, minoxidil can help stimulate hair regrowth. It is often used in combination with other therapies, but is less effective as a standalone treatment for extensive hair loss^[26].

Anthralin: This topical medication is applied and then washed off after a specified period to irritate the skin,

which can stimulate regrowth. It may cause skin irritation and staining^[27].

Treatments for extensive alopecia areata

Patients with widespread hair loss (over 50% of the scalp), including alopecia totalis (entire scalp) and alopecia universalis (entire body), often require more potent, systemic therapies^[28].

Topical immunotherapy: Chemicals like diphenylcyclopropenone (DPCP) are applied to the scalp to induce an allergic rash. This process redirects the immune response and can cause hair regrowth. Weekly treatments are administered at a dermatologist's office^[29].

Oral corticosteroids: Systemic steroids may be used for rapid or extensive hair loss, but their use is limited due to significant side effects and the high rate of relapse after stopping treatment.

Immunosuppressants: Other oral immunosuppressants, such as methotrexate and cyclosporine, may be used for severe cases that do not respond to other treatments^[30-31].

Janus Kinase (JAK) Inhibitors: JAK inhibitors are small molecules that interfere with the signaling of multiple cytokines that are implicated in AA including interferon- γ and interleukin-15. Several JAK inhibitors have been used to treat AA in both topical and systemic formulations^[32].

Micronutrient Supplementation: Many patients and providers advocate for supplementation of micronutrients in the treatment of AA. Although data supports an association between lower levels of serum vitamin D, zinc, and folate levels in patients with AA as compared to controls, there is a lack of data evaluating the benefit of supplementation of these^[33].

Herbal Treatment

Herbal plants are the most important part of our life. Any plant organ such as root, stem, leaves, flowers and fruits are used in some medicinal, culinary or fragrant properties. A herb is a plant that is valued for qualities such as medicinal properties, flavour, scent or the extracts and like. Traditional medicine or folk medicine practices are based on the use of plants and plant extracts^[34].

Traditional medicine systems offer approaches to AA treatment. Ayurveda aims to balance bodily energies and cleanse toxins. Key Ayurvedic herbs used include Bhringraj, known for stimulating hair growth, Amla, which supports scalp health with antioxidants, Ashwagandha, an adaptogen that helps manage stress, and Neem, used for its anti-inflammatory properties. Detoxification methods like Shirodhara and Panchakarma are also employed.

Traditional Chinese Medicine (TCM) considers AA to result from internal imbalances like stagnant Qi or blood deficiency. Herbs such as He Shou Wu are used to tonify organs and improve blood circulation. Dang Gui is used to enhance blood flow and balance

hormones. Korean Red Ginseng may promote hair growth through anti-inflammatory effects. TCM often utilizes herbal formulations combining several ingredients^[35].

Topical Herbal Treatments

Aromatherapy using essential oils in carrier oil can be massaged into the scalp to help stimulate hair follicles and support hair growth.

Essential oils: Lavender, rosemary, thyme, and cedarwood oils have shown promising results in clinical studies, with one randomized trial showing significant improvement over carrier oil alone.

Irritants: Garlic and onion juice contain sulfur and are believed to stimulate blood circulation and regenerate hair follicles when applied topically. These may cause skin irritation.

Herbal pastes and oils:

Coconut oil: Often used as carrier oil, coconut oil has antimicrobial and antifungal properties and helps moisturize and nourish the scalp.

Aloe vera: Applying fresh aloe vera gel can help soothe and hydrate the scalp and has anti-inflammatory properties.

Fenugreek (methi): Soaked and ground fenugreek seeds can be made into a paste and applied to the scalp. It is rich in proteins and nicotinic acid, which may promote hair growth.

Ayurvedic oils: Bhringraj and Brahmi oils are traditionally used in Ayurvedic practice to promote hair growth and strengthen hair roots.

Oral Herbal Supplements

Some herbal supplements are used to support overall health and address factors like stress that may worsen autoimmune conditions.

Ayurvedic herbs: Ashwagandha is an adaptogenic herb known for helping the body manage stress and anxiety, which can be triggers for alopecia areata. Other Ayurvedic herbs like Amla, Brahmi, and Triphala are also used internally.

Pumpkin seed oil: This oil has been studied for its effects on androgenic alopecia, acting as a 5-alpha reductase inhibitor to block DHT. One study showed a significant increase in hair count in men with alopecia.

Quercetin: Found in fruits and vegetables, preliminary animal research suggests quercetin may protect against and treat alopecia areata. However, more human research is needed.

Herb's used in treatment of alopecia

Night jasmine

It is obtained from arborists it is cultivated in tropical and subtropical regions it contains terpenes, steroids, flavonoids, alkaloids, and aliphatic compounds. Ethanolic extract of whole plant initiate hair growth so used in the treatment of alopecia it is also used as a microbial antioxidant, antipyretic^[36].

Mulethi

Its biological name is *Glycyrrhiza glabra* it grows in the Mediterranean, southern and central Russia, Asia Minor to Iran its chemical components are 18-beta-glycyrrhetic acid, nitro glycyrrhizin, and liquiritigenin. It is employed for the treatment of stomach ulcers, non-alcoholic fatty liver disease, dry mouth heartburn it promotes hair growth and clean scalp^[37].

Ginkgo biloba

It is commonly known as a maiden tree it is native to china it contains lactone, bilobalide, isorhamnetin, flavones, ginkgo acid, and ginkgo poxin. It is used in traditional medicine dietary supplements, antioxidants, it improves blood circulation hence promote hair growth^[38].

Amla

Its biological source is *Phyllanthus emblica* it grows in tropical and subtropical areas of China, India, Indonesia, and Thailand. It contains Vitamin C chebulagic acid, pedunculagin, and punigluconin. One of the best things you can do to prevent hair fall is to massage your hair with amla oil it increases the blood circulation throughout the scalp^[39].

Onion

It is obtained from *Allium cepa* it contains quercetin, alliinase, allicin, diallyl disulfide, and diallyl trisulfide onion juice improve hair growth by boosting levels of antioxidant enzyme catalase content of sulfur present in it nourish follicles it reverses premature graying and delay graying^[40].

Rosemary

Its biological name is *Rosmarinus officinalis*. It is cultivated in India its chemical constitutes are volatile, resin, ursolic acid its oil is used in hair lotions and hair gels to promote hair growth and shine^[41].

Walnut

It is obtained from *Juglans regia*. It is native to the region stretching from the Balkans eastward to Himalayas and Southwest china widely cultivated across Europe. It contains hexadecane, nonacosanol pentadecane, bicyclogermacrene, and spathulenol. It accelerates hair growth as an antioxidant and provides moisture to skin and scalp^[42].

Aloe vera

Its biological name is *Aloe barbadensis* belonging to family Liliaceae Aloe vera leaves are used; it contains various minerals such as calcium, phosphorus, and potassium iron chloride. It contains vitamins such as Vitamin A, Vitamin B, Vitamin C, Vitamin E, and Vitamin M. Its chemical constituents are saponins, anthraquinones, and amino acids^[43].

Heena

It is obtained from *Lawsonia inermis*. It grows and cultivated in India. It contains linalool alpha-terpineol, triphenylvinyl 1.5 indanedione, eugenol, and hexadecenoic acid. It gives volume to the hair shaft and improves hair texture boost scalp health and unclogs pores^[44].

Neem

It is obtained from *Azadirachta indica* belonging to family Meliaceae. It grows widely in the sub-Himalayan belt at an altitude of 700, 10,000 m above sea level. It contains flavonoids, steroids, terpenoids, sterols, nimbolide, nimbin, and salannin. Many commercial shampoos contain neem oil for the growth of hair and to control ticks, fleas, and lice^[45].

Shikaki

Its biological name is *Acacia concinna*. It belongs to the Mimosaceae family. This shrub is widely found in the plains of South India. It contains spinasterol lupeol acetic acid, lactone, urushiol, and rhamnase. It is a great source of essential vitamins such as Vitamin C. It promotes hair growth by giving the scalp an allogenic boost^[46].

Basil oil

Its biological source is *Ocimum sanctum* it contains linalool est Rogol eugenol, methyl eugenol, monoterpene, and methyl cinnamate. It increases blood circulation to promote hair growth. It is also used as anti-inflammatory, anti-oxidant, and antibacterial^[47].

Jojoba oil

Biologically it is known as *Simmondsia chinensis*. It is a shrub native to Southern Arizona, Southern California, and Northwest Mexico. It has palmitic acid, lignoceric acid, behenic acid, stearic acid, erucic acid, and nervonic acid. It prevents and stops hair loss and thinning caused by clogged hair follicles. It is rich in vitamins and minerals so it promotes hair growth and stops hair fall.

Arnica

Its biological source is *Arnica montana*. It contains helenalin 11 alpha13-dihydro helenalin, sesquiterpene lactones. It rejuvenates the scalp stimulates hair follicles to improve blood flow prevent premature hair fall^[48].

Sesame oil

Sesamum indicum is its biological name. It has linolenic acid, oleic acid palmitic acid, and stearic acid. Vitamins such as Vit C, Vit E, Vit K, and minerals such as calcium iron magnesium and phosphorus. It triggers hair growth by nourishing the root with rich omega fatty acid. It improves circulation and rejuvenates hair follicles^[49].

Cedarwood oil

It is biologically *Juniperus virginiana* belong to initial parts of the plant used wood chips and sawdust. It contains terpenoids and used for aromatherapy^[50].

Fenugreek

Its common name is methi and the biological name is *Trigonella foenum graecum*. It contains trigonelline, yamogenin, gypsogenin, and sotolon. It belongs to the Fabacean family. It provides nutrients to the scalp and promotes hair growth^[51].

Jatamansi

It is obtained from Rhizomes of *Nardostachys jatamansi*. It is belonging to Valerianaceae Bromoacetate, Valeranone, methyl lithium 1 ether, and 1,8-cineol are the chemical constituent it does follicular enlargement and prolongation of the anagen phase^[52].

Gudhal

It is obtained from flower hibiscus *Rose sinensis*. Sinn belongs to family Malvaceae. Its chemical constitutions are flavones, cyclopeptides, alkaloids, pentatriacontane, riboflavin, and thiamine. It promotes hair growth by follicular enlargement and prolongation of the anagen phase^[53].

Bhringraj

Its biological source is leaves of *Elipta Alba* Sinn family which are Asteraceae. Its chemical constituents are Elipta saponin c, daucosterol, and stigmaterol 3-0-glucoside. It works in the treatment of alopecia. It promotes hair growth by enlargement of the anagen phase^[54].

Brahmi

Biologically known as *Centella asiatica*, the family is Umbelliferae. Its chemical composition is cucurbitacin, Bacoside A3, Pseudocucurbitacin, Bacopside II, Bacopside X, β -sitosterol, α -alanine, and stigmaterol. It promotes hair growth so it is employed in the treatment of alopecia^[55].

Coconut

Its biological source is *Cocos nucifera* Sinn. It is a family in Palma. It stimulates hair growth. The vitamin and essential fatty acids naturally found in coconut oil, it nourishes the scalp and helps to remove serum fluid up from hair follicles. It has lauric acid, decanoic acid, cytokinin, caprylic acid, Cysteine Proline, and polyphenol oxidase^[56].

Tulsi

It contains dried fresh leaves of *O. sanctum* Sinn and *Ocimum basilicum* belonging to the family Samaceal. It is an herbaceous, much planted annual plant found throughout India. It is considered sacred by Hindus. It contains Eugenol, Carvacrol, Eugenol-methyl ether, caryophyllene, alkaloids, glycosides, Saponin, Tannins, and Vit-C. One of the major causes of hair loss is dandruff and dry scalp. Tulsi improves blood regulation and keeps your scalp cool and reduces itching and thus promotes hair growth^[57].

CONCLUSION

Alopecia is one of the main problems amongst urban people to domination to stress environmental problems etc. So, with the help of this review article, we conclude that many herbal drugs having potency for curing alopecia with no side effects. The various types of allopathic drugs to treat hair loss but they have many side effects. Herbs are starting material for any medication research. Approximately about 80% residents recommended herbal drugs for their beneficial effects along with fewer side effects as compared synthetic drugs.

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