



## Exploring herbal remedies for hair care: A review of medicinal plants and their benefits

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### Abstract

Hair care is an essential aspect of personal grooming, and many people seek natural remedies to promote hair growth, prevent hair loss, and maintain healthy hair. This review highlights the potential of herbal plants in hair care, focusing on their bioactive compounds, benefits, and uses. Plants like Amla (*Emblica officinalis*), Bhringraj (*Eclipta alba*), Hibiscus (*Hibiscus rosa-sinensis*), Shikakai (*Acacia concinna*), Onion (*Allium cepa*), Henna (*Lawsonia inermis*), and Rosemary (*Rosmarinus officinalis*) have been traditionally used to promote hair growth, reduce dandruff, and improve hair texture. These plants contain various bioactive compounds, including flavonoids, tannins, saponins, and antioxidants, which contribute to their hair care benefits. The review discusses the use of these plants in hair care and their potential as natural remedies for hair-related issues.

**Keywords:** Herbal Remedies; Hair Care; Medicinal Plants; Natural Products; Hair Growth; Hair Loss.

### 1. Introduction

Hairs are one of the most essential elements that complement an individual's looks, so it is important to take proper care of them [1]. Hair is a cohesive structure with distinct physical and chemical properties. It is a very strong and elastic thin, flexible keratin thread [2]. One of the distinguishing features of mammals that comes from the skin is hair. In addition to providing the skin with physical protection and thermal insulation, it also serves as an organ for the dispersion of sweat and sebum. Although it is undesired, both males and females experience rapid hair loss, which has clinical implications and is typically linked to generalized thinning of the scalp [3]. In animals worldwide, hair has a number of beneficial properties. Around the pinnacle and other delicate parts of the frame, it makes a protective cushion. Hair care products are defined as formulations that can be used to clean, modify the texture of hair, nourish hair, and maintain the healthy appearance of hair [4]. Hair features such as length, color, texture, and shape express not only the physical sense of hair look but also play an important function on a more intimate and emotional level, such as self-esteem, social and psychological concerns. Also, the variety of its qualities, such as curvature, thickness, and color, can serve as an identifiable characteristic for each ethnicity around the world [5]. One important physical characteristic that greatly influences a person's psychosocial personality is their hair. Dermal papilla cells (DPCs), which are composed of mesenchymal and epithelial-derived root sheath cells, make up hair follicles (HFs). DPCs produced from mesenchymal cells interact with root sheath cells derived from epithelial cells. There are three stages in the hair growth cycle. These stages, which stand for growth, regression, and rest, respectively, are anagen, catagen, and telogen. A variety of cytokines that regulate the cycle and growth of hair are also produced and released by DPCs [6]. One important skin appendage that comes from the ectoderm is the hair follicle (HF). The HF helps to remodel its cutaneous milieu, including skin innervation and vascular, by acting as a hair shaft factory and a storehouse of stem cells [7]. The major constituents of a mature human HF are the characteristic mesenchyme of dermal papilla cells (DPCs) and multilayered,

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concentric epithelial basement cylinders of keratinocytes. During embryonic development, B lymphocyte-induced maturation protein-1b fibroblasts, commonly referred to as dermal stem cells (DSCs), give rise to human DPCs (hDPCs). DSCs are extensively researched as important regulators of the HF growth cycle throughout an animal's life cycle because of their capacity to activate epithelial hair follicle stem cells (HFSCs). Growth can be influenced by a variety of internal and external variables in HFs [8]. Hair follicles and an individual's age determine the typical monthly growth rate, which is roughly half an inch [9]. Alopecia, or hair loss, is a prevalent medical condition that can impact both men and women. Mammals are known for their hair, which is a thread-like development of the epidermis, the outermost layer of skin. Hair is an essential component of attractiveness, social acceptance, and self-esteem. Hormonal changes, nutritional deficiencies, genetics, drugs, inflammation, injuries, and even operations are some of the various causes of hair loss. Nowadays, there are numerous widely accessible treatments for hair loss, such as hair transplantation, platelet-rich plasma, and traditional chemical methods (minoxidil, finasteride, or herbal extracts) [10]. The pathogenesis of androgenetic alopecia (AGA), a condition in which hair loss results from an excess of dihydrotestosterone, a metabolite of testosterone, has long been researched [11]. Alopecia areata (AA), androgenetic alopecia (AnA), and TE are examples of non-scarring types of alopecia, while scarring causes include cicatricial alopecia. While AnA refers to hair loss in both male and female patterns, which is defined by the increasing shortening of anagen cycles, alopecia areata is marked by circular bald patches that may or may not overlap [12]. About half of both men and women suffer with AGA. 2% of people suffer with AA. 50% of women and 70% of men may have hair loss at some point in their lives. Elevated 5- $\alpha$ -dihydrotestosterone (DHT), dysregulated transforming growth factor- $\beta$  (TGF- $\beta$ ) signaling, and increased 5- $\alpha$ -reductase activity are all linked to AGA. The discovery of lymphocytic infiltrates in AA lesions led to the theory that hair follicles (HFs) are the target of an autoimmune attack, most likely as a result of immunological T cell-mediated loss of immune privilege [13]. The processes by which dihydrotestosterone (DHT) causes baldness are still unknown, even though this fact is well acknowledged. Rebora has suggested three mechanisms: (a) miniaturization due to a DHT-induced acceleration of the matrix's mitotic rate, which reduces the amount of time available for differentiation; (b) increased telogen shedding, which results from the hair cycles shortening and raises the number of telogen cells per unit of time; (c) and the longer duration and greater number of tenogens or lag phases. The DHT-related process is still unknown. The main androgen in the bloodstream, testosterone, is converted by tissue's 5 $\alpha$ -reductase to DHT, a stronger androgen. In hair follicles, DHT is more likely than testosterone to combine with the androgen receptor (AR), which encourages the anagen and catagen processes into telogen and then metabolizes to cause baldness [14].

Three terms have been used by Ayurveda to denote hair disease:

- Khalitya: Denoting hair loss
- Palitya: Denoting early graying of the hair
- Indralupta: Denotes alopecia universalis, totalis, and areata [15].

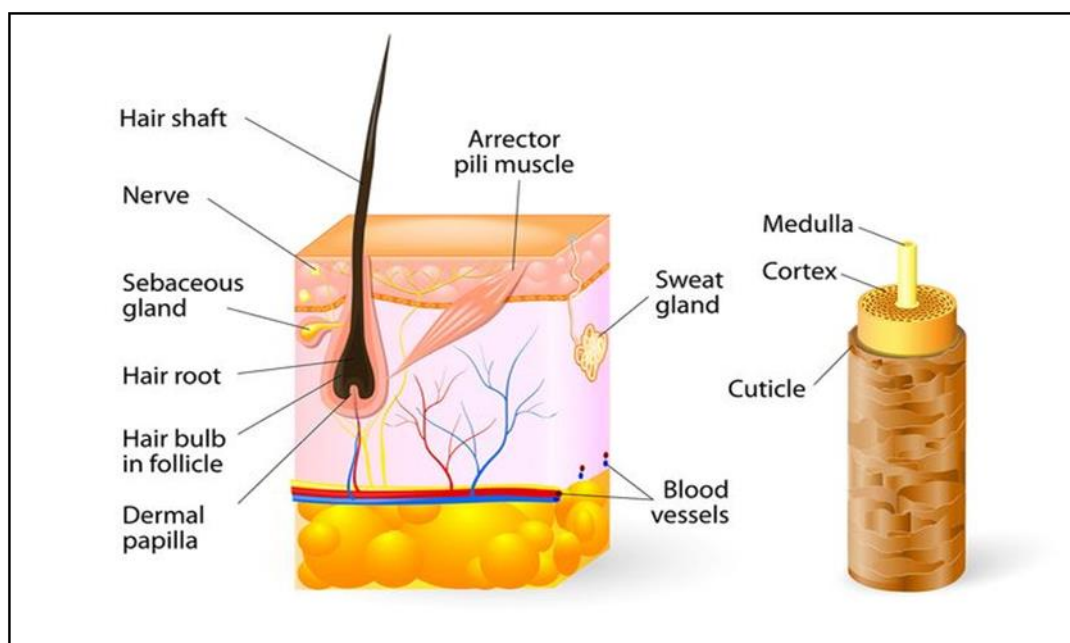
Several herbal medications are recommended by India's traditional medical system for promoting hair growth. A survey of uncommon plants used to treat hair issues is included in the article.

## 2. Basic Structure and Anatomy of Hair

Human hair plays a significant role in our daily lives. Keratinization of germinative cells generated from ectoderm results in the creation of hair, an epidermal offshoot. The only parts of the human body without hair are the palms, soles, and fingers. Among its many functions, hair reduces friction between hair shafts, regulates body temperature, shields the body from the sun, and protects against external influences. One of the chemical elements of the fibrous alpha-keratin proteins that comprise hair is carbon. Below is an explanation of the structure of hair [17].

### 2.1. Hair follicle

Hair is retained in place and starts to grow at the hair follicle. It begins in the epidermis and resembles stockings. It reaches the dermis. The outer and inner sheaths that line the follicle stop immediately before the sebaceous gland opens, protecting and shaping the developing hair.



**Figure 1** Structure of hair [16].

## 2.2. Hair shaft

Part of the hair composed of three layers of keratin is called the hair shaft.

These layers are as follows:

- The inner layer, also known as the medulla. The presence of the medulla varies depending on the kind of hair.
- The cortex, which comprises the majority of the hair shaft, is the middle layer.
- The outer layer, also known as cuticle, is made up of closely spaced scales that overlap and have a structure similar to roof tiles [18].

## 2.3. The Cuticle

The cuticle, a protective layer covering human hair, is made up of six to ten layers of cells that are between 0.2 and 0.5 mm thick. By decreasing the flow of moisture into and out of the underlying cortex, it also preserves the elasticity and hydration balance of the hair.

## 2.4. The Cortex

The cortex, which is made up of lengthy keratin filaments bound together by hydrogen and disulfide bonds, gives the hair its primary bulk and color. With a diameter of 3 to 6 mm and a length of up to 100 mm, the cortical cells are aligned and densely packed.

## 2.5. The Medulla

The medulla, the innermost layer of hair, is present in thicker hair types. Its soft, thin core is made up of air gaps and translucent cells [19].

## 2.6. Growth Cycle of Hairs

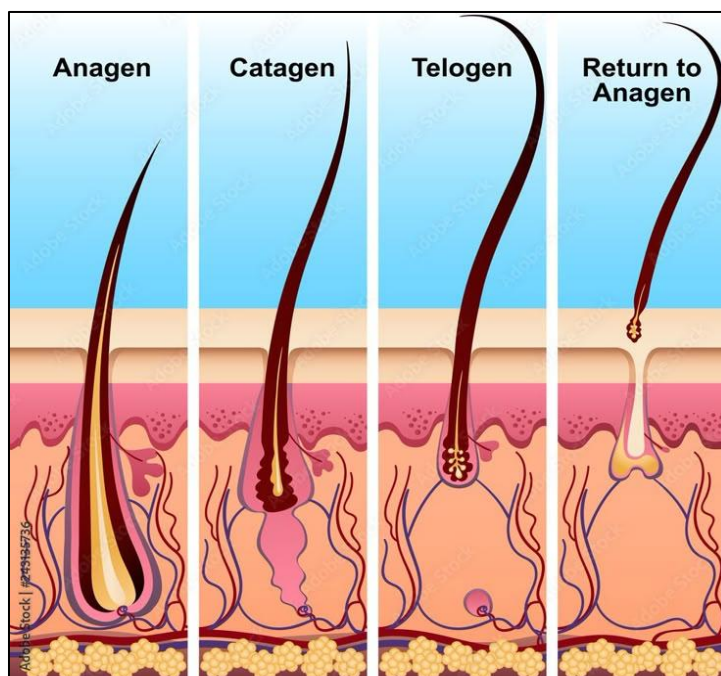
There are three stages in the hair growth cycle, which are:

**Anagen (Growth phase)** – After birth, the body starts to enlarge during the four weeks of true anagen. At the anagen stage, a new lower hair follicle is created by proliferating stem cells in the bulge area. Keratin 15 and integrin are found in the swelling cells or units that make up human hair follicles. The hair matrix momentarily multiplies cells similarly to proliferate and then differentiate into distinct epithelial hair lineages when it is generated from epithelial high-

frequency stem cells in the bulge. However, during the anagen, catagen, and telogen stages of development, the hair follicle stem cells cycle incredibly slowly [20].

**Catagen (Regression phase)** – The hair advances to the next stage and growing activity rises during the recession period. 10–14 days make up the regression period [21].

**Telogen (Resting phase)** – This stage, which lasts for 90 to 100 days, is when hair is at rest. Typically, 50–100 hairs are randomly exfoliated each day. The transition of hairs into a resting condition is known as the telogen phase. Alopecia, or hair loss, occurs when a person loses more than 100 hairs each day, albeit this condition may be transient [22].



**Figure 2** Hair Growth Cycle [23].

## 2.7. Symptoms of Hair Loss

Hair loss is caused by a number of circumstances. Below are some of the primary factors:

acute sickness, autoimmune diseases, substances (hair dyes), Chemotherapeutic medications, Diabetes hair loss after giving birth, items for hair styling, methods for styling hair, elevated iron insufficiency, deficits in nutrition, Additional fungal diseases, injury to the scalp, poisons, inadequate nutrition or malnourishment, poor blood circulation, prescription medications, psychological, exposure to radiation, Ringworm Skin conditions, stress, abrupt reduction in weight, surgery illness of the thyroid [24].

## 2.8. Factors Affecting Hair Health

### 2.8.1. Diet

Hair loss results in excessive use of nutritional supplements, such as micronutrients (vitamins A, E, and selenium). Hair health is also impacted by carbohydrates. One of the indirect causes of hair loss is the use of processed foods high in simple sugar.

### 2.8.2. Chemical Exposure

One risk factor for alopecia is exposure to heavy metals including thallium and mercury. The harmful effects of such substances on hair have been demonstrated by studies.

### 2.8.3. Diseases or Disorders

Hair health is impacted by abnormal skin disorders such psoriasis, tinea capitis, atopic dermatitis, and dandruff/seborrheic dermatitis.

### 2.8.4. Smoking

Smoking is linked to baldness in men and early graying of hair in women.

### 2.8.5. Stress

Stress increases the likelihood of both hair loss and hair growth suppression. Chronic or acute stress is a main inducer of hair growth disease, namely, telogen effluvium; it works as an aggravating factor for hair development disorders such as androgenetic alopecia and alopecia areata [25].

### 2.8.6. Hair care products

Individuals' physical appearance is greatly influenced by their hair color, complexion, and style. Preparations for hair care are administered topically to the hair and scalp. These include excipients that either nourish, cleanse, or condition hair to stop dandruff from growing.

Various hair care preparations are as follows:

- **Hair cleanser:** e.g. Shikakai, Soap nut.
- **Conditioner:** e.g. Tea, Hibiscus, Amla.
- **Hair growth promoters:** e.g. Amla, sesame oil, Brahmi, Hibiscus.
- **Nourisherse:** e.g. Coconut oil, Brahmi, Bhringraj.
- **Anti dandruff:** e.g. Hirda, Soap nut, Thyme, Behada [26].

## 3. Herbal Plants Used in Hair Care

### 3.1. Amla (*Emblica officinalis*)



**Figure 3** Amla (*Emblica officinalis*) [32].

Another name for it is the Indian gooseberry. It comes from *Emblica officinalis*, a deciduous tree that grows widely throughout India. Gujarat, Uttar Pradesh, Maharashtra, and Rajasthan are among the states where it is farmed. [27] It is the most abundant source of vitamin C. Since amla contains over 80% moisture, it's a great hydrating option for dry hair. It works as a natural conditioner and effectively cleanses the scalp of oil, dust, and other impurities. Amla is an excellent nourishing choice for dry hair, as it comprises around 80% moisture. It removes oil, dust, and contaminants from the scalp while also acts as a natural conditioner. The outcome is hair that is excessively shiny and healthy [28]. Applying water to hair nourishes it and promotes darkening. [29]. Numerous bioactive components, including vitamin C, gallic acid, ellagic acid, tannins, flavonoids, and polyphenols, are present in *Emblica officinalis*. There are antioxidant benefits of gallic acid. Typically, hair loss is treated with ellagic acid. Because tannins tighten the cuticles, the hair becomes smoother and more glossy. Hair follicle growth and repair are aided by flavonoids [30]. Coconut oil infused with amla fruit has been used as a home treatment for premature greying and darkening of the hair. It has been reported that the tannins in amla induce an affinity between the hair strand and the hair dye. It is typically used with other natural

hair dyes, such henna, in hair products. Microscopic analysis revealed that the amla-infused shampoo's color penetrability compared with commercial shampoo and that it effectively reduced hair graying. Amla has also been shown to maintain hair melanin and promote hair pigmentation [31].

### 3.2. Bhringraj (*Eclipta alba*)

It is developed in all sessions in India. All of Earth's tropical regions are suitable for its cultivation. It uses the entire plant. The Asteraceae is the family name. The plant is known by its scientific name, *Eclipta alba*. The leaves are essentially green. The stems, seeds, and fruits are all brown. The root is gray. The seeds have a hairy appearance as well. Alkaloidal components such as ecliptine, nicotine, wedelic acid, wedelo lactone, luteolin, epigenin, resin, and glycosides are present in it. Another application for it is as an anti-dandruff agent to get rid of dandruff from the hair. It is used as an agent to promote and regulate hair growth. The hair gets stronger as a result. It can also be used to nourish hair [33]. It is primarily used to increase hair strength, growth, and blackening. It is the primary component of many hair oils. It effectively addresses hair-related issues like baldness, premature greying, dandruff, and hair loss [34]. Hair color can be made from black dye obtained from *E. alba*. In cases of androgenic alopecia, the  $\beta$ -sitosterol molecule found in *E. alba* can aid in hair growth [35].



**Figure 4** Bhringraj (*Eclipta alba*) [36].

### 3.3. Hibiscus (*Hibiscus rosa-sinensis*)

Isagenus of flowering plants belonging to the Malvaceae family. Flowers of the hibiscus plant are good for the skin and hair. It has some incredible qualities that can help you treat issues with your skin and hair. Hydroxy acids, which are abundant in hibiscus, help improve the health and appearance of your skin. These are some incredible skin and hair advantages of hibiscus. Hibiscus is rich in vitamin C and A, iron, and antibacterial, anti-inflammatory, and antioxidant qualities. Vitamin C is abundant in hibiscus extract, which is also a potent antioxidant. Hibiscus blossoms are an excellent dietary supplement for reducing bacterial acne and excessive sebum production [37]. All year long, blooms are produced by a huge flowering shrub with simple alternate leaves. Poultices made from flowers can improve hair hydration and lessen damage. For example, an extract from *Hibiscus rosa-sinensis* flowers has been demonstrated to work as an anti-solar agent by absorbing UV rays, making it a useful remedy for skincare and hair care products [38]. Vitamin B1, riboflavin, calcium, phosphorus, iron, niacin, and vitamin C are all found in hibiscus, and they are used to encourage the growth of thicker hair and postpone the onset of greying. It is used to promote hair growth. Hibiscus is used to smooth and shine hair [39].



**Figure 5** Hibiscus (*Hibiscus rosa-sinensis*) [40].

### 3.4. Shikakai (*Acacia concinna*)

*Acacia Concinna*, the scientific name for this herb, is a climbing plant that promotes hair development. lowers hair loss, lessens skin problems, and manages dandruff. Because these soap pods contain natural surfactants, they are used to cleanse the scalp and fortify the hair from the roots up. ensuring scaling comfort. It transforms hair like magic. *Acacia concinna* Linn. (Leguminosae) is a medicinal shrub that grows in tropical rainforests in southern Asia. This plant's fruits are used as an emetic, expectorant, purgative, and to promote hair growth. The powder of *Acacia concinna* Linn contains flavonoids, anthraquinone glycosides, sugar, tannin, alkaloids, and saponins.

#### 3.4.1. Benefits of Shikakai

- Impart shine and softness to hair
- Remove hair lice and dandruff
- Provide stronger and thicker hair
- Nourishes hair follicles [41].
- Clean hair
- Add more light
- Prevents hair loss [42].



**Figure 6** Shikakai (*Acacia concinna*) [43].

### 3.5. Onion (*Allium cepa*)

Liliaceae is the family name. *Allium cepa* L. is the plant's scientific name. Patchy baldness has also been proven to benefit from onions. In the morning and evening, apply onion juice to the affected area until it turns red. After that, you should rub it with honey. Zinc prevents dandruff, which can lead to hair loss, and helps the scalp secrete much-needed oil. The oxygenation of your body's red blood cells depends on iron. It is necessary for healthy hair maintenance and regular

hair growth [44]. By increasing blood flow to the scalp and hair, it helps stop hair loss. The juice's sulphur aids in the synthesis of vital collagen, which encourages hair growth [45]. Onion bulb crushed promotes hair development. and combined with honey, which is good for baldness [46].



**Figure 7** Onion (*Allium cepa*) [47].

### 3.6. Henna (*Lawsonia inermis*)

A member of the Lythraceae family, Henna (*Lawsonia inermis* Linn.) has long been used in Ayurvedic medicine for cosmetic purposes, particularly because of its beneficial effects on skin and hair. There are various medical applications for henna. Indeed, the extract has antibacterial, antifungal, antiviral, hepatoprotective, hypoglycemic, antioxidant, wound-healing, and antimycotoxin properties. Hennotannic acid-rich leaves (2-hydroxy-1,4-naphthoquinone) are mostly used in the Mediterranean region to make a natural hair, skin, and nail coloring as well as to make elaborate temporary tattoos to adorn hands and feet [48]. This is a naturally occurring vegetable dye. Locally, it is referred to as Laali or Lalle [49]. Henna can "stain" the color onto the hair shaft because of its inherent affinity for the proteins in our hair [50].



**Figure 8** Henna (*Lawsonia inermis*) [51].

### 3.7. Rosemary (*Rosmarinus officinalis*)

The well-known herb rosemary (*Rosmarinus officinalis* L.) has been well researched for its many uses in the culinary and pharmaceutical industries [52]. The Lamiaceae family includes rosemary. The Mediterranean region is home to the powerful rosemary herb. Rosemary plants are not commonly cultivated in India. Europeans brought its garden plants because of its beautifully fragrant leaf. There are 20 different types of rosemary plants, including creeping rosemary, spice islands rosemary, pink rosemary, white rosemary, upright rosemary, pine-scented rosemary, and golden rain rosemary [53]. In addition to improving scalp circulation and promoting healthy hair development, rosemary oil helps reduce dandruff. It has a lot of antibacterial qualities [54].



**Figure 9** Rosemary (*Rosmarinus officinalis*) [55].

#### 4. Conclusion

Herbal plants offer a promising approach to hair care, with many plants showing potential in promoting hair growth, preventing hair loss, and maintaining healthy hair. The bioactive compounds present in these plants, such as flavonoids, tannins, and saponins, contribute to their hair care benefits. While traditional knowledge and scientific evidence support the use of these plants in hair care, further research is needed to fully understand their efficacy and safety. Nevertheless, these herbal remedies can be a valuable addition to conventional hair care practices, offering a natural and potentially effective way to promote hair health. By exploring the potential of herbal plants in hair care, we can develop new, natural products that cater to the growing demand for organic and sustainable hair care solutions.

#### Compliance with ethical standards

##### *Disclosure of conflict of interest*

No conflict of interest to be disclosed.

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