

(REVIEW ARTICLE)



## Phytochemicals in hair care: A review of natural ingredients and their applications

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### Abstract

Phytochemicals are increasingly being used in hair care products due to their potential benefits for hair growth, strength, and texture. This review article discusses the various natural ingredients used in hair care products, including herbs, essential oils, and plant extracts. The article highlights the benefits of using phytochemicals in hair care, including their ability to promote hair growth, reduce dandruff, and improve scalp health. The review also discusses the different types of hair loss, including alopecia areata, androgenetic alopecia, and telogen effluvium. Furthermore, the article explores the various applications of phytochemicals in hair care, including their use in hair oils. Overall, this review article provides a comprehensive overview of the use of phytochemicals in hair care and highlights their potential benefits for promoting healthy hair.

**Keywords:** Hair care; Hair growth; Natural ingredients; Hair oil; Hair loss

### 1. Introduction

Products made from natural sources, like as plants or algae, are known as phytocosmetics. Extracts, essential or fixed oils, or unstructured materials (such resins, waxes, fats, etc.) that serve as the product's active ingredients are examples of natural components in phytocosmetics. According to Marcal, these formulations, which contain some synthetic components, are mostly derived from vegetables. In the pharmaceutical industry, natural oils are increasingly being used in place of synthetic ones. Cosmetics because of the former's harmful effects [1]. In addition to protecting the scalp from mechanical abrasion and sunlight, hair enhances people's well-being. To cure and shield the hair fiber from everyday external hair aggressions, it is crucial to design hair care formulas. The main purposes of aims formulae are to enhance the physical characteristics of the hair fiber, such its combability, strength, and texture. Enhancing sensory qualities like brightness, smoothness, frizz reduction, and hair film creation are the secondary purposes [2]. Individuals skin and hair beauty can be influenced by their health, lifestyle, regular jobs, climate, and upkeep. Excessive heat exposure throughout the summer dehydrates the skin, resulting in wrinkles, freckles, blemishes, pigmentation, and sunburns. Cracks, wounds, maceration, infections, and hair loss are all signs of damage to the skin and hairs caused by the harsh winter [3]. Herbs and essential oils used in cosmetics shouldn't be utilized with the intention of having any therapeutic effects or penetrating the skin's outer layers [4]. Natural ingredients, botanical compounds, and "free-from" claims (such as "free from" salts, sulfates, silicones, parabens, and other potentially dangerous substances) are the primary attributes that consumers in the hair care sector seek out [5]. Any portion of the plant, including the bark, rhizomes, fruits, flowers, seeds, roots, and flowering tops, is referred to as a herb. The shape or state of the herbs in which the plant material is utilized is referred to as an herbal ingredient. For example, extracts, essential and fixed oils, powders, juices, etc [6]. The average woman's hair surface area is between four and eight square meters. Up until the middle of the 1930s, hair was cleaned using bar soap. However, the development of liquid coconut oils made it possible to create a liquid soap that was more effective at lathering and rinsing than bar soap [7]. There are numerous chances to incorporate phytochemicals into skin and hair care products that adhere to the guidelines for both cosmetic preparation and traditional medical practices such as Tibetan, Siddha, Ayurvedic, and Unani [8]. During puberty, the

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beard's tiny, light-pigmented hairs are replaced with thicker, darker hairs. On the other hand, later in life, thick scalp hairs become fine, tiny hairs. Ironically, the hormone testosterone triggers both processes [9]. One of the minor diseases that affects roughly 1.7% of the world's population is hair loss, which presents a difficult problem for doctors [10]. Hair tonics and hair grooming tools are the two primary categories into which hair care products fall. In essence, these are oil-based extracts of therapeutic herbs [11]. For continually men and women, hair loss is a draining situation [12]. There is currently little, conflicting, and equivocal scientific evidence supporting the importance of essential oils for hair health [13]. Hair oils are hair care products used to prevent and treat hair aggression, balding, and other conditions [14]. Hair loss is a dermatologic disorder, and the search for natural products which has hair growth promoting potential is continuing [15].

## 2. Plant profile

### 2.1. *Emblica officinalis*: [16]

- Botanical Name(s) - *Emblica officinalis*
- Kingdom- Plantae
- Division- Magnoliophyta
- Class -Magnoliopsida
- Order - Euphorbiales
- Family- Euphorbiaceae
- Genus- *Phyllanthus* L
- Species- *Phyllanthus emblica* L.
- Popular Name(s)- *Phyllanthus Emblica*, *Emblica*, *Amla*
- Part use -Fruit
- Habitat- Northern and South Western
- Uses- Use in herbal oil, shampoo for hair loss, Scalp dryness, dandruff and infections [17].



**Figure 1** *Emblica officinalis* [16]



**Figure 2** Dried fruit of *Emblica officinalis* [16]

#### 2.1.1. Plant description

Fruits are round, appear firm, and range in hue from light green to yellow. It has an acidic, bitter, or sour flavor. The bark of the Amla, or Indian gooseberry, it has fluffy, lemon-scented leaves that are rectangular in shape and turn gray when dried.

### 2.2. *Hibiscus rosasinensis*: [16].

- Kingdom - Plantae-Plants
- Subkingdom - Tracheobionta-Vascular plants
- Super division - Spermatophyta-Seed plants
- Division - Magnoliophyta-Flowering plants
- Class - Magnoliopsida-Dicotyledons

- Subclass - Dilleniidae
- Order - Malvales
- Family - Malvaceae - Mallow family
- Genus - *Hibiscus L.* - Rosemallow
- Species - *Hibiscus rosa-sinensis L.*



**Figure 3** Hibiscus rosa- sinensis flower



**Figure 4** Hibiscus rosa- sinensis plant

#### 2.2.1. Plant description

Red hibiscus, another common name for Rosa-sinensis, is a big shrub that can reach a height of 4.7 meters. This plant can be upright and varies in height. The ovate-shaped leaves, which range in length from 5 to 15 cm, are placed alternately on the branches. The leaves have serrated margins and can be either dark green or variegated with lighter areas. The enormous red blooms can reach a length of 15 cm.

#### 2.2.2. Collection of Plant Materials [18]

The polyherbal hair oil was prepared by collecting various plant materials like cucumis melo varagretis leaves, cucumis melo varagretis seeds, Indian tinospora leaves, neem, curry leaves, hibiscus leaves, hibiscus flowers, Aloevera, onion, fenugreek, castor oil were procured.

### 2.3. Coconut oil



**Figure 5** Coconut oil [18]

- Biological source: Oil derived from dried fruits of *Cocos nucifera*.
- Family: *Arecaceae*.
- Use: moisturizer, vehicle, stimulates hair growth by unclogging pores.



## 2.4. Geranium oil [19]

Vitamins A and C, which are believed to improve hair health, are abundant in geranium oil. It is well renowned for having antifungal and anti-inflammatory qualities that may improve the general health of hair. Because of this, it's a great choice for a hair product. Geranium oil is a rich source of nutrients that revitalizes and renews your skin and hair.



**Figure 6** Geranium oil [19]

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## 3. Plant Material Used in Hair Cosmetics

### 3.1. Bhringraj: [11]

Bhringraj might be referred to as False Daisy in English. *Eclipta Prostrata* is Bhringraj's botanical name. *Eclipta alba*, a botanical synonym for *Eclipta Prostata*, is another name for it, belonging to the Asteraceae family. It works well as a medication for conditions affecting the skin, cough, asthma, eyes, and any other area of the head. It addresses premature graying of the hair, stops hair loss, and promotes hair growth.

### 3.2. Golden Root: [20]

*Rhodiola rosea*, that is frequently referred to as Roseroot or Aaron's rod, is a plant that evolves well in cold regions and relates to the Crassulaceae family. Long utilized in traditional European and Asian medicinal systems to boost an organism's resilience to physical stress, *rhodiola* root is now generally believed to possess antioxidative qualities.

### 3.3. Marigold (*Calendula officinalis*): [21]

Pot marigold is the plant *Calendula officinalis*. It should not be mistaken for other kinds of plants, including those in the genus *Tagetes* 27, that are more frequently referred to as marigold. An extract of the entire plant (*Calendula officinalis* Extract), the flowers, flower extract, and flower oil (*Calendula officinalis* Flower Extract, *Calendula officinalis* Flower Oil), and the seed oil (*Calendula officinalis* Seed Oil) are among the ingredients used in cosmetics and personal care products. *Calendula* flower extracts are the most widely employed chemical in cosmetics and personal care products.

### 3.4. Almond oil: [22]

*Prunus dulcis* is the source of almond oil. In essence, 78% of this fat is found in almond oil. Very trace levels of super-unsaturated Omega-3 essential fatty acids are present in this oil. It softens and strengthens hair and turns out to be highly nutritious. Additionally, the almond oil works wonders as a cleanser. Prior to its widespread use as a commercial agro-product, almond oil was utilized for many millennia.

### 3.5. Ginger: [23]

*Zingiber officinale*, the botanical name for ginger, is a member of the Zingiberaceae family. It is extracted from *Zingiber officinale* roots. Adrak, Gingerin, Zingiber, and Zingiberis are synonyms for ginger. Zingiberene is present, and the Shogaols are renowned for their nutraceutical properties. Gingerol, one of the active components and antioxidants in ginger, helps to relax blood vessels and enhance blood flow to hair follicles. Additionally, it keeps hair from thinning, promotes hair development, and makes hair smooth and shiny. It also beneficial for treating inflamed, itchy scalps and dandruff. Natural anti-inflammatory and antibacterial qualities found in ginger help to maintain healthy, clear skin.

### 3.6. Brahmi (*Bacopa monnieri*): [24]

It can be used to hair to make it lustrous and to eradicate lice and dandruff, and it can be used as a face pack to improve the complexion of the face.

### 3.7. Henna: [25]

The most popular is henna, which is used as a natural hair dye and for temporary body tattoos. Henna has been utilized by eastern cultures for thousands of years and has various medicinal benefits. Cleopatra herself used henna to paint her body.

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## 4. Factors of hair loss: [26]

- Autoimmune diseases
- Chemicals (color for hair)
- Drugs and agents used in chemotherapy.
- Diabetes
- Postpartum hair loss
- Hair styling products
- Hairstyle methods
- Increased iron insufficiency
- Inadequate nutrition
- Additional fungal diseases
- Damage to the scalp
- Poisons
- Inadequate blood flow

### 4.1. Hair Growth Cycle

The filamentous biomaterial known as hair develops from dermal follicles. Hair is one of the characteristics that distinguish the mammalian class and is found only in mammals. The term "hair" is frequently used to describe two different structures: the hair follicle, which is located beneath the skin, and the bulb, which is removed from the skin. The shaft, the rigid filamentous portion that protrudes above the skin's surface, and stem cells, which aid in hair regrowth following a fall or wound, are maintained by this flesh organ [27]. Three criteria major stages of development of hair are anagen, catagen, and telogen. During the anagen phase, hair is growing actively. The catagen phase is defined by the resorption and damage of the hair follicle's bottom region. The telogen phase is the point when the hair is at rest not increasing. The three main phases of a hair growing cycle are anagen, catagen, and telogen. In this phase, the hair follicle's growth in the scalp resumes. The growth cycle's anagen phase usually lasts a period of three to five years. On a healthy scalp, there are approximately 1,000,000 hair and 90% of the follicles are continually in the anagen phase of hair growth. When a follicle starts to go dormant at the end of the growth period, it enters the catagen stage. The telogen stage is a three to four month quiescent or resting phase. An old hair falls out toward the end of the dormant phase. A new hair then starts to grow when a hair follicle goes back to the anagen stage. Hair follicles and an individual's age determine the typical monthly growth rate, which is roughly half an inch [28].

### 4.2. Phases of Hair Growth cycle: [29]

- **Anagen phase:** This stage is frequently referred to as the hair growth phase. The anagen phase lasts between two and six years, during which time new hair grows and pushes out of the follicle.
- **Catagen phase:** This stage, known as the transitional phase, affects roughly 3% of all hair at any given moment.
- **Telogen phase:** This stage, which typically lasts two to three months, is a time for rest. During this stage, hair follicles are at rest and fully developed club hairs are formed.

### 4.3. Hair Structure and its characteristics: [30]

Every human hair originates from a distinct hair follicle, which is made up of two primary parts: the hair shaft and the hair bulb.

#### 4.3.1. The Hair bulb

The developing hair cells, including melanocytes that produce melanin, the pigment that gives hair its color, are housed in the hair bulb, which is found at the base of each hair follicle.

#### 4.3.2. The Hair shafts

Keratin protein that has been compressed and united makes up the hair shaft, which is visible above the scalp. There are three layers to it.

#### 4.3.3. The Cuticle

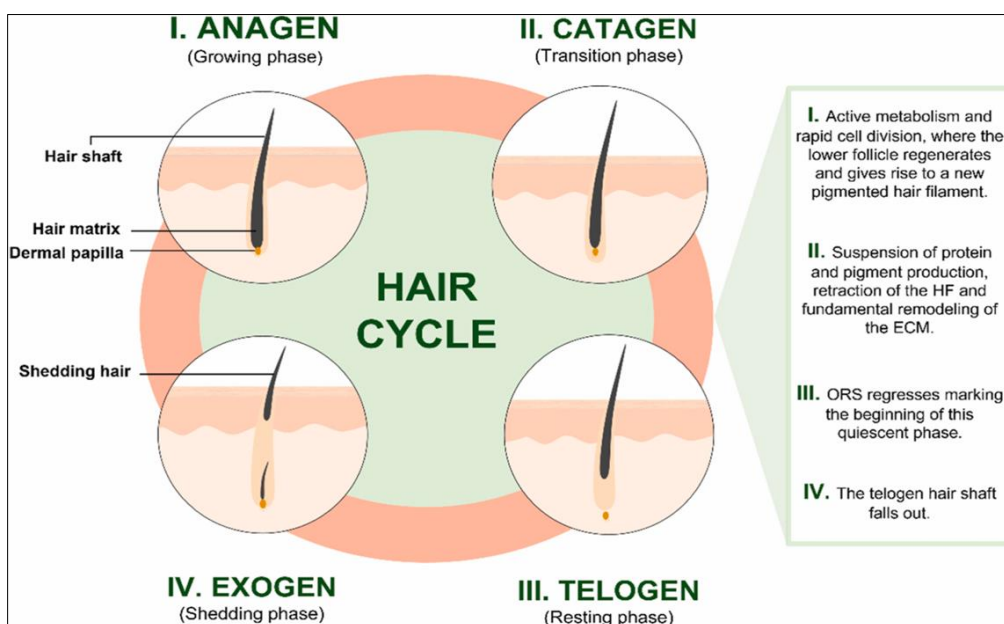
The cuticle, a protective layer covering human hair, is made up of six to ten layers of cells that are between 0.2 and 0.5 mm thick. By decreasing moisture transport in and out of the underlying cortex, it also preserves the flexibility and hydration balance of the hair.

#### 4.3.4. The Cortex

The cortex, which is made up of lengthy keratin filaments bound together by hydrogen and disulfide connections, 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.

#### 4.3.5. The Medulla

The medulla, the innermost layer of hair, is present in thicker hair types. Its delicate, thin core is made up of air gaps and transparent cells.



**Figure 7** Schematic representation of hair growth cycle [31]

**Table 1** Ingredients used in polyherbal hair oil [32][8]

Sr. No.	Ingredients	Uses
1	Eclipta alba Linn. (Leaves)	Paste of herb is useful to control skin diseases and eczema
2	Euphorbia thymifolia Linn.	Plant extract is useful to control ringworm and skin infections.
3	Acacia concinna DC.	Pods extract is used as hair cleanser and for control of dandruff.
4	Trigonella foenum-graecum Linn.	Seed extract is used as hair cleanser.
5	Phyllanthus emblica Linn.	Fruit extract is used in oils for promotion of hair growth.
6	Zea mays Linn.	Stigma extract is used in creams and lotions for skin rejuvenation.
7	Flavoring agent	Enhanced flavour.

#### 4.4. Types of hair loss

- **Alopecia Areata (prime stage)**- Alopecia areata is a prevalent autoimmune condition that causes hair loss on the scalp and other areas. One or more tiny, round, smooth, non-scarring spots are typically where it begins. A patient who frequently experiences temporary alopecia areata but never develops alopecia totalis is said to have mild brief alopecia areata or universalis [26].
- **Temporary Alopecia Areata**- Alopecia areata patients are in the advanced stages, and some of them develop totalis or universalis [26].
- **Ophiasis Alopecia Areata**- Alopecia areata of the ophiasis kind manifests as band-like hair loss. It usually affects the progressive or occipital regions of the scalp, making treatment more challenging because most medications work slowly in these regions [26].
- **Alopecia Totalis**- Hair loss along the entire scalp [28].
- **Trichotillomania**- The patient refers to this kind of hair loss as compulsive pulling or dull self-pulling (26).
- **Traction Alopecia**- Hairstyles that knot hairs too tightly might lead to adhesion alopecia and excessive traction at the hair roots [26].

#### 4.5. Type of Hair Oil

##### 4.5.1. Coconut oil: [33]

Coconut oil helps reduce hair protein loss both before and after washing. Coconut oil is known to contain lauric acid, a type of fatty acid with a low molecular weight and a linear structure that may penetrate the hair shaft.

##### 4.5.2. Argon oil: [34]

Therefore, if coconut oil is derived from coconuts, then argans are used to make argan oil. Moroccan trees of the argan variety produce nuts with their fruits, and it is from these tiny nuts that argan oil is produced.

##### 4.5.3. Avocado oil: [33]

Avocado oil Avocado oil is nutrient rich. Vitamin E, an antioxidant that may help stop hair loss and encourage hair growth, is abundant in it.

##### 4.5.4. Different oils: [33]

Different oil Some types of oils that can help prevent dryness and damage to hair while also boosting elasticity are olive oil, jojoba oil, almond oil, and grapeseed oil.

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### 5. Management of Hair Loss: [27]

Drugs that promise to cure hair loss are aimed at a multibillion dollar, continuously expanding global market. Pharmaceutical treatments for hair loss have many prospects, however the accessibility of certain treatments has not significantly improved. Recent developments in our knowledge of the origin and course of alopecia have led to changes in the state of treatment. The main non-surgical treatment approaches for promoting hair growth are angiogenesis (via endogenous substances), androgen antagonism, vasodilation by potassium channel opening, inhibition of 5-alpha reductase, and hair cycle management. Two US FDA-approved synthetic medications that are also being used to treat androgenic alopecia are minoxidil (good for both male and female pattern baldness) and finasteride (good for male pattern baldness); however, their side effects have decreased their use. These synthetic chemicals can cause dermatitis, erythema, scaling, pruritus, gynecomastia, itching, or skin rash, among other negative effects.

#### 5.1. Benefit of Herbal Hair Oil: [35]

- Encourage the development and thickness of hair
- To make your hair thicker and longer
- To keep your hair healthy
- Preserving your hair's color
- It promotes the growth of hair.
- Promotes hair growth
- Prevents dandruff
- Reduction of stress
- Scalp nourishment

- Strengthening of hair follicles
- Enhances the gloss and structure of hair
- Therapeutic benefits of aroma
- Chemical-free and natural

## 5.2. Application: [36]

- They don't cause allergic reactions or adverse side effects.
- Natural cosmetics are safer to use than other beauty products.
- All skin kinds can use herbal cosmetics; that is, they work well on all skin types.
- The cost of herbal cosmetics is low.
- They blend in with skin and hair with ease.
- When use in tiny doses, they are much more effective than synthetic cosmetics.
- Easily accessible and plentiful in both number and variety [36].

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## 6. Conclusion

Phytochemicals have been increasingly recognized for their potential benefits in promoting hair growth, strength, and texture. This review article highlights the various natural ingredients used in hair care products, including herbs, essential oils, and plant extracts. The benefits of using phytochemicals in hair care are numerous, including promoting hair growth, reducing dandruff, and improving scalp health. Furthermore, this review article discusses the different types of hair loss and the various applications of phytochemicals in hair care. Overall, the use of phytochemicals in hair care offers a natural and effective approach to promoting healthy hair. Future research should focus on exploring the potential of phytochemicals in preventing and treating hair loss, as well as investigating their mechanisms of action.

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## Compliance with ethical standards

### *Disclosure of conflict of interest*

No conflict of interest to be disclosed.

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