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REVIEW ARTICLE

Harnessing Herbal Ingredients in Hair Cosmetics: A Natural Approach to Hair Care

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Abstract

Hair plays a crucial role in the human body and it is imperative to uphold a healthy scalp. Various factors, including hormonal influences, age, gender, pollution, and food habits impact the hair. Herbal ingredients such as amla, hibiscus, brahmi, neem, saw palmetto etc are widely used to treat hair disorders such as premature hair loss, dandruff, and canities. Herbal ingredients may be used in hair shampoos, oils, tonics, serums, gels, conditioners etc. This article offers a detailed examination of the utilisation of natural components in hair care products, emphasising their importance and advantages in supporting scalp health, encouraging hair growth, and improving overall hair condition. It also reviews the sensory aspect and potential aromatherapy of herbal hair treatments. The article addresses the challenges and considerations related to herbal formulations, such as individual sensitivities, shelf life, and the need for transparency in labelling.

Keywords: Applications, Challenges, Formulations, Hair Problems, Herbal Ingredients

1. Introduction

In a world where beauty and wellness are increasingly intertwined, using herbal ingredients in hair cosmetics represents a return to nature, drawing upon centuries of traditional knowledge and the powerful healing properties of plants. The traditional practices in Ayurveda, Traditional Chinese Medicine (TCM), and Indigenous healing systems have utilized the power of plants to maintain and enhance hair health. In India, herbal medicines are mostly used for their day-to-day health problems. This is the reason there are about 6,000 herbal medicines manufacturers in India. According to the World Health Organization (WHO), about 80 per cent of the world's population uses herbal medicines[1,2]. Herbal ingredients have been cherished for centuries across diverse cultures for their natural and holistic benefits in hair care. As modern consumers increasingly seek sustainable and chemical-free alternatives, the spotlight has returned to traditional remedies that harness the power of nature. Herbal treatments are increasingly in demand worldwide due to the lack of adverse reactions and effects compared to synthetic formulas[3,4]. Herbal formulations have gained an important position all over the world because they are composed entirely of natural products[5,6]. Compared to some synthetic compounds like sulfates, parabens, and silicones, which are often associated with long-term damage, herbal ingredients tend to have fewer side effects[7]. However, individual reactions are different, and it is important to be careful with herbal products, especially if a person has allergies or specific health conditions[8]. Herbal remedies are commonly perceived as gentle on the body and suitable for long-term use, underscoring the importance of responsible utilization and, when needed, consultation with healthcare professionals[9,10].

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As per the pieces of literature, cosmetics preparation can be carcinogenic or cause genetic mutations[9,11]. Given their seriousness, they have been listed as a priority for carcinogens and have been modified by many international pollution agencies, such as the European Commission (EC), the Registry of Toxic Substances and Diseases (RTSD), the Environmental Protection Agency (EPA), the International Cancer Research Agency (ICRA) and the United States Environmental Protection Agency (USEPA), in 1984.

The use of herbal ingredients in hair care products is rooted in their potential to provide nourishment, promote scalp health, and stimulate hair growth. The detailed exploration of herbal hair cosmetics, including the selection of herbal ingredients, carrier oils, essential oils, and other beneficial components[12]. Herbal hair care involves using extracts, oils, and powders derived from various plants to treat common hair concerns, such as hair loss, dandruff, dryness, and scalp irritation. Table 1 provides a comprehensive overview of herbal ingredients used in hair cosmetics, highlighting their significance and benefits in promoting hair health. This article focuses on the use of herbal ingredients in various hair cosmetics, including hair oil, hair tonics, hair serums, hair gels, hair creams, and conditioners, showcasing their diverse applications and benefits[13]. Combining ancient wisdom with modern science, using herbal ingredients in hair care promises a holistic approach to beauty and wellness.

2. Hair Disorders

The issues associated with hair include male pattern baldness, unruly hair, lack of hair volume, moisture, premature greying, dandruff, and hair thinning[73]. In Figure 1 most common hair problems are shown. Studies indicate that a genetic inclination, when coupled with environmental stimuli, is a key factor in the onset of hair problems, underscoring the intricate interaction between genetic vulnerability and environmental influences in hair-related conditions. The most serious dermatological condition is premature hair loss. The causes of hair loss are not yet fully understood, and its full medical treatment has not been satisfactorily developed. One of the main causes of hair loss is iron deficiency i.e., anaemia[9]. There are various hair loss treatments, but none of them is 100% effective. To treat hair loss, many herbs such as Hibiscus, Neem, Amla, Methi, Tusi, Brahmi, Lemon, Shikakai, Nutmeg, Helena, Reetha, Musk, Mahahringraj, Jantamasi, Chitraka, Marjoram, Parsley, Rosemary, Thyme are often used18. Amla in plants is the main source of vitamin C and contains phosphorus, calcium and iron, which provide nutrition for normal hair growth and are also used for hair blackening. Hibiscus contains calcium, iron, B1, phosphorus, riboflavin, niacin, and vitamin C, which prevents premature hair colouration and provides thicker hair. Brahmi consists of alkaloids that promote the activity of protein kinase. Methi has high protein feed that serves as a protein supplement to provide hair nutrition[11,37,74].

2.1 Androgenetic Alopecia

Healthy men and women generally have 80,000 to 120,000 important terminal hairs on the scalp. Hair consists of keratin and is produced in hair follicles. All hair follicles undergo a series of growth and rest cycles[75,76]. The complaint of hair loss may be related to two things: an increase in hair loss every day (effluvium) or visible hair loss i.e., alopecia[11,77]. Usually, up to 100 hair falls every day. It is important to ask patients about the drugs they take. Disease or medication to treat that disease can be a part of the problem of hair loss[78].

Androgenetic alopecia is the most common type of hair loss that affects 70% of men and 40% of women[79]. Androgenetic alopecia is characterised by step-wise minimisation of the hair follicle due to changes in the dynamic of the hair cycle that lead to the transformation of the hair of the last hair follicle. 11. The normal hair cycle has an active growth phase (anagen), which lasts from 2 to 6 to 7 years. In a short regression phase, catagen takes one to two weeks, followed by the rest phase telogen, which takes five to six weeks and about 100 days. The catagen phase is an involution process in which apoptosis deforms out the most follicular keratinocytes along with the determination of pigment production and the condensation of the skin papillae. As a result, the face flap moves upwards. In the telogen phase, the hair shaft matures into a club hair (vellus). After washing and washing, the hair finally falls out and the anagen phase begins again. In Androgenetic alopecia, the duration of the anagen decreases gradually and the duration of the telogen phase increases[80,81]. Distanceof the length of the anagen phase determines

Table 1. Herbal ingredients and their effects on hair growth

Name of plant	Hair related application	References
Aloe vera	Aloe vera is believed to possess hydrating properties that could be advantageous for the scalp, potentially aiding in the reduction of dandruff and fostering a conducive environment for hair growth.	14
Nettle	Nettle root extract is considered to have the ability to hinder the hormone dihydrotestosterone (DHT), which is linked to hair loss.	15
Ginseng	Ginsenosides, which are active components found in ginseng, might exhibit anti-inflammatory and vasodilatory effects that have the potential to support the growth of hair.	16
Saw Palmetto	Similar to nettle, saw palmetto is thought to impede DHT, potentially diminishing hair loss.	17
Rosemary	Rosemary oil could enhance blood circulation to the scalp, thus potentially fostering hair growth.	18
Peppermint	Peppermint oil, containing menthol, is believed to provide a cooling effect and enhance blood flow to the scalp.	19
Lavender	Lavender oil is assumed to possess antimicrobial properties that could promote a healthy scalp.	15
Thyme	Thyme oil may possess antimicrobial properties and could contribute to fostering a healthy scalp environment.	18
Horsetail	The presence of silica in horsetail extract may improve the health and strength of hair.	15
Chamomile	Chamomile has the potential to soothe the scalp and alleviate irritation.	20
Green Tea	Green tea polyphenols may offer antioxidant effects that could be advantageous for hair health.	21
Hibiscus	Hibiscus is thought to fortify hair, prevent breakage, and reduce hair fall.	22
Fenugreek	Fenugreek seeds are rich in proteins and nicotinic acid, which could potentially stimulate hair growth.	23
Burdock Root	Burdock root oil is believed to ameliorate scalp conditions and foster hair growth.	15
Licorice	Liquorice extract might possess anti-inflammatory properties that could aid in soothing the scalp.	24
Bhringraj	Bhringraj oil is traditionally utilized in Ayurveda for promoting hair growth and preventing hair loss.	25
Brahmi (*Bacopa*)	Brahmi is believed to strengthen hair roots and nourish the scalp.	26
Reishi Mushroom	Reishi may exhibit immune-modulating effects that could indirectly impact hair health.	27
Moringa	Moringa is abundant in nutrients and antioxidants that could contribute to overall hair health.	28
Jojoba	Jojoba oil moisturizes the scalp, thus assisting in preventing dryness and flakiness. A healthy scalp environment might bolster hair growth.	29
Argan Oil	Rich in vitamins and antioxidants, argan oil can nourish and hydrate the scalp, fostering healthy hair.	30
Coconut Oil	Coconut oil, with its hydrating properties, may penetrate the hair shaft, reducing protein loss and preventing damage.	21
Olive Oil	Olive oil can provide moisture to the hair and potentially assist in preventing breakage and split ends.	29
Almond Oil	Almond oil, containing vitamin E and omega-3 fatty acids, offers nourishment and potentially encourages hair growth.	31
Castor Oil	Castor oil is believed to strengthen hair, prevent breakage, and nourish the scalp, commonly used in treatments for hair growth.	32

Table 1. Continued...

Pumpkin Seed Oil	Pumpkin seed oil, which is high in antioxidants and zinc, may encourage the development and health of hair.	33
Flaxseed Oil	Flaxseed oil, with its omega-3 fatty acids, might contribute to healthy scalp and hair growth.	34
Sesame Oil	Sesame oil could aid in maintaining a healthy scalp and promoting overall hair health.	35
Grape Seed Extract	The antioxidants present in grape seed extract could contribute to a healthy scalp environment.	36
Amla (Indian Gooseberry)	Amla is rich in vitamin C and antioxidants, potentially promoting hair growth and strengthening hair follicles.	37
Maca Root	Maca root is abundant in vitamins and minerals, which play a role in enhancing overall hair health.	38
Yucca Root	Yucca root extract is believed to stimulate hair growth and fortify hair strands.	39
Red Clover	Red clover might contain isoflavones that potentially have a positive impact on hair growth.	40
Ylang-Ylang Essential Oil	Ylang-ylang oil is thought to regulate scalp oil production and minimize hair breakage.	41
Clary Sage Essential Oil	Clary sage oil may aid in balancing scalp oils and fostering a conducive environment for hair growth.	42
Lemongrass Essential Oil	Lemongrass oil could possess antimicrobial properties that contribute to scalp cleanliness.	43
Tea Tree Essential Oil	Because of its antibacterial qualities, tea tree oil may be useful in preserving scalp health.	44
Ginger	Ginger has the potential to enhance blood circulation and possess anti-inflammatory properties, which can support the health of hair.	45
Cinnamon	Cinnamon may offer antimicrobial benefits that are conducive to a healthy scalp.	46
Fennel	Fennel may contain essential nutrients that promote the health and growth of hair.	47
Onion Extract	Onion extract is believed to stimulate hair follicles and aid in the promotion of hair growth.	48
Garlic Extract	Garlic extract is thought to have antimicrobial properties that can help maintain scalp health.	49
Cucumber Extract	Cucumber extract is believed to possess soothing properties that can be advantageous for the scalp.	50
Sea Buckthorn Oil	Sea buckthorn oil is abundant in vitamins and fatty acids, which may contribute to the well-being of hair.	51
Raspberry Leaf Extract	Raspberry leaf extract may contain nutrients that support hair growth.	52
Elderberry Extract	Elderberry extract is rich in antioxidants and may play a role in maintaining a healthy scalp.	53
Comfrey Extract	Comfrey extract has soothing properties that can benefit the scalp.	54
Calendula Extract	The anti-inflammatory qualities of calendula extract may benefit scalp health.	55
Arnica Extract	Arnica is believed to have anti-inflammatory properties that can help soothe the scalp and create a healthy environment for hair growth.	56
Ginkgo biloba	*Ginkgo biloba* may improve blood circulation, potentially benefiting the scalp and hair follicles.	57
Marigold Extract	Marigold, or calendula, extract has anti-inflammatory effects that can be soothing to the scalp.	30
Shikakai	*Shikakai* has a history of use in hair care for its cleansing and conditioning properties.	18

Table 1. Continued...

Gotu Kola	*Gotu kola* may enhance blood circulation and collagen production, potentially benefiting the scalp and hair.	49
Juniper Berry Essential Oil	Juniper berry oil may have antimicrobial and astringent properties that can benefit the scalp.	58
Palmarosa Essential Oil	*Palmarosa* oil is believed to regulate sebum production and nourish the scalp.	59,60
Patchouli Essential Oil	*Patchouli* oil is considered to have anti-inflammatory and antifungal properties that may be beneficial for the scalp.	61
Carrot Seed Essential Oil	Carrot seed oil is rich in vitamins and antioxidants, supporting hair health.	62
Vetiver Essential Oil	Vetiver oil is believed to have calming and grounding properties that can be beneficial for scalp health.	63
Wheat Germ Oil	Wheat germ oil is rich in vitamin E and may contribute to overall hair health.	64
Safflower Oil	Safflower oil is thought to have hydrating properties that promote a healthy scalp.	65
Mustard Seed Oil	Mustard seed oil is believed to stimulate hair growth and improve scalp health.	66
Apricot Kernel Oil	Apricot kernel oil can moisturize the scalp and contribute to overall hair health.	67
Sweet Almond Oil	Sweet almond oil is nutrient-rich and may nourish both the scalp and hair.	68
Sunflower Oil	Sunflower oil may have moisturizing properties that benefit both the scalp and hair.	69
Evening Primrose Oil	Evening Primrose Oil, abundant in gamma-linolenic acid (GLA), possesses potential anti-inflammatory properties that may be advantageous for the scalp and could stimulate hair growth.	70
Borage Oil	Like Evening Primrose Oil, Borage Oil also contains gamma-linolenic acid (GLA) which could potentially enhance the general health of the hair.	71
Cumin Extract	Though Cumin is traditionally used, there is limited scientific evidence to support its direct influence on hair growth.	72

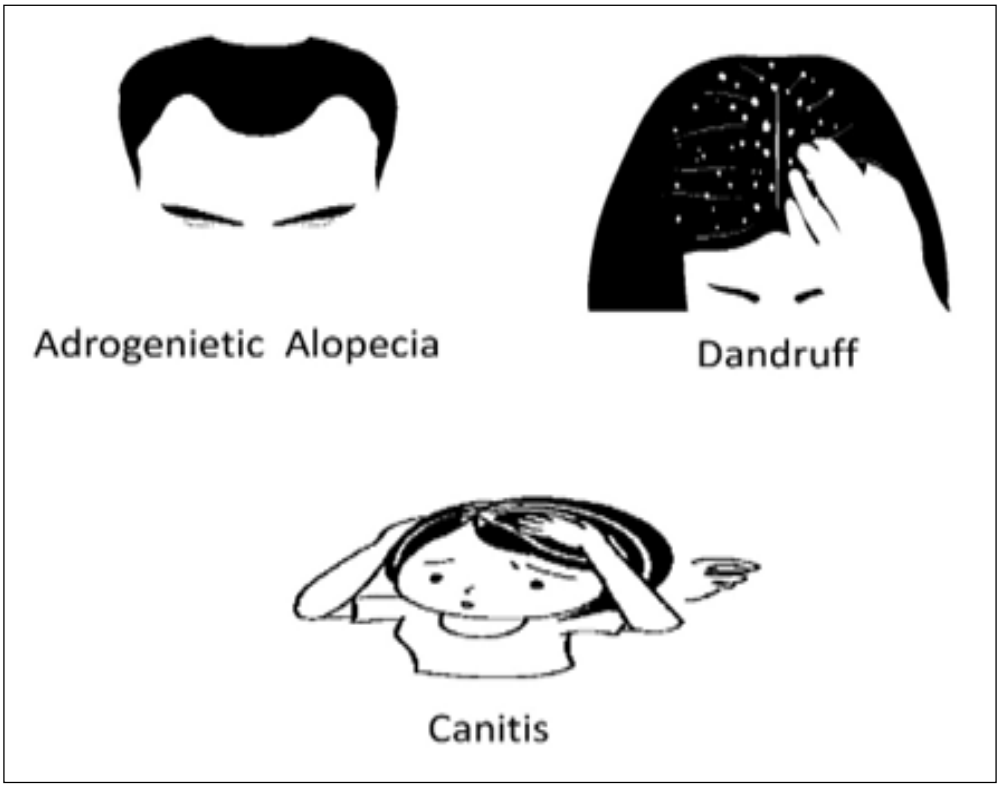

Figure 1. Common hair problems.

the length of the hair, the maximum length of the new anagen hair is shorter than the previous one, resulting in miniaturization and, ultimately, the appearance of baldness[79].

2.1.1 Herbal Medicines for Androgenetic Alopecia

Saw Palmetto (*Serenoa repens*) commonly known as saw palmetto, is a diminutive palm that originates from the southeastern part of the United States[17]. It has gained recognition for its potential therapeutic attributes, especially in the treatment of Benign Prostatic Hyperplasia (BPH) and androgenetic alopecia, which is characterized by the patterned thinning or loss of hair in both men and women[82]. The berries of the saw palmetto plant contain a complex composition of fatty acids, phytosterols, flavonoids, and other bioactive compounds[83]. The primary mode of action is thought to involve the inhibition of 5-alpha-reductase, an enzyme responsible for the conversion of testosterone into dihydrotestosterone (DHT). By diminishing DHT levels, saw palmetto holds promise in mitigating the hormonal factors that contribute to hair loss and enhancing the health of hair follicles[84–86].

2.2 Dandruff

Dandruff is a common scalp condition characterized by the shedding of dead skin cells from the scalp, often resulting in visible white or yellowish flakes. It can be accompanied by itching and irritation of the scalp. While the exact cause of dandruff is not fully understood, several factors are believed to contribute to its development, including yeast overgrowth, sebum production, skin sensitivity, poor hygiene[87]. Malassezia, a type of yeast that naturally resides on the scalp, can proliferate excessively under certain conditions, leading to dandruff[88]. Malassezia feeds on the natural oils produced by the scalp, and its metabolic byproducts can irritate the skin, causing increased shedding of skin cells[89]. Sebum production is the overproduction of sebum, the natural oil produced by the scalp, which can create an environment conducive to the growth of Malassezia and exacerbate dandruff symptoms[90]. Individuals with sensitive skin may be more prone to developing dandruff, as their scalp may react more strongly to irritants or allergens[91]. Infrequent shampooing or inadequate cleansing of the scalp can allow dead skin cells, oils, and other debris to accumulate, contributing to dandruff formation[92].

2.2.1 Herbal Medicines for Dandruff

Melaleuca alternifolia, commonly known as tea tree oil, possesses potent properties that exhibit antifungal and antibacterial effects. Thus, it is highly effective in combatting the presence of dandruff-causing yeast, specifically Malassezia. Additionally, its anti-inflammatory properties aid in soothing scalp irritation and alleviating itching. To apply tea tree oil, it is recommended to dilute it with a carrier oil, such as coconut or olive oil, and directly administer it to the scalp. Alternatively, one may choose to incorporate it into their shampoo or conditioner to enhance its effectiveness in fighting dandruff[21]. Due to its efficacy in controlling dandruff and promoting scalp health, tea tree oil is a key component in numerous commercially available anti-dandruff shampoos and hair care products. However, it is crucial to conduct a patch test before extensive usage, as certain individuals may exhibit sensitivity, resulting in irritation or allergic reactions. Furthermore, it is imperative to adhere to the provided instructions using tea tree oil, as excessive concentrations may lead to irritation[44].

2.3 Canities

Grey hair is an intrinsic component of the natural progression of ageing characterized by the depletion of pigment (melanin) within the hair follicles, resulting in the emergence of grey or silver strands. The production of melanin, which imparts colour to the hair ranging from black to brown to blonde, is facilitated by melanocytes, specialized cells housed within the hair follicles. Multiple factors such as genetics, age, hormonal changes, and nutritional deficiencies play a role in the manifestation of this occurrence[93]. The timeline and extent of grey hair development are primarily dictated by genetic predisposition. Some individuals may experience the onset of greying in their twenties or thirties, whereas others may retain their original hair colour well into their later years[94]. The emergence of grey hair is an inherent ramification of the ageing process, as the melanocytes progressively diminish in activity or cease to function over time, thereby leading to a decrease in melanin production[95].

Alterations in hormonal levels, particularly during menopause or other instances of hormonal instability, can exert an influence on melanin production and contribute to the commencement of grey hair. Certain nutritional inadequacies, particularly in vitamins B12 and D, as well as copper, have been associated with untimely greying[96].

2.3.1 Herbal Medicines for Canities

He Shou Wu, also referred to as *Polygonum multiflorum* or Fo-Ti is comprised of a range of chemical constituents to contribute to its potential efficacy in treating canities (grey hair). He Shou Wu encompasses various key chemical compounds, including Anthraquinones (Emodin and physcion), Stilbenes, Phenolic Glycosides (such as 2,3,5,4'-tetrahydroxy stilbene-2-O-β-D-glucopyranoside), and Lecithin[97]. He Shou Wu possesses antioxidant activity, due to anthraquinones, stilbenes, and phenolic glycosides. These compounds exhibit antioxidant properties that have the potential to safeguard melanocytes, responsible for the production of melanin pigment, against oxidative damage caused by free radicals[98]. Consequently, this protection may potentially impede the decline in melanin production within hair follicles, thereby delaying the onset of grey hair. Furthermore, He Shou Wu demonstrates anti-inflammatory effects owing to certain compounds like resveratrol. These compounds possess anti-inflammatory properties, which are particularly significant as chronic inflammation is associated with various ageing processes, including premature greying of hair. By diminishing inflammation in the scalp and hair follicles.

He Shou Wu may assist in sustaining healthy hair pigment production. In addition, He Shou Wu is believed to regulate melanin production, although the precise mechanisms remain unclear. It is hypothesized that certain compounds present in He Shou Wu may exert an influence on melanin synthesis or stimulate melanocyte activity, which in turn leads to the restoration of hair colour[99].

3. Hair Formulations

Hair formulations comprise a diverse array of products crafted for cleansing, conditioning, styling, and treating the hair. The ingredients, consistency, and desired effects of these formulations can significantly differ depending on the unique requirements of various hair types and the intended results. Various types of hair formulations and their respective functions are outlined below:

3.1 Shampoo

Maintaining a good scalp and hair hygiene is a very important part of healthy hair. Shampoos primarily consist of washing bases, which are a blend of surfactants possessing cleansing properties for the elimination of dirt and dust from the scalp and hair[100,101]. The inclusion of this blend enhances the efficacy of the products by mitigating the intense impact exerted by a singular surfactant. Specifically, detergents can be categorized into anionic, cationic, amphoteric, and nonionic surfactants based on their chemical constituents[102].

There exists a substantial quantity of plants that possess advantageous impacts on hair[103]. Herbal ingredients are frequently employed in shampoos due to the presence of vitamins, amino acids, sugars, glycosides, phytohormones, bioflavonoids, fruit acids, and essential oils[104]. In recent times, there has been a noticeable transformation in consumer preferences towards products that utilize the capabilities of nature, and shampoos containing herbal hair formulations have emerged as a preferred option for individuals desiring a more natural method of hair maintenance. These shampoos, fortified with plant-based extracts and herbal constituents, not only pledge to purify the hair but also to provide essential nutrients and invigorate it. In this examination, we will delve into the realm of shampoos containing herbal hair formulations, scrutinizing their primary ingredients, advantages, and the surging inclination towards a more comprehensive approach to hair care. Herbal shampoos that are used for hair formulations set themselves apart by including a diverse selection of extracts derived from plants, as well as essential oils and herbal ingredients[102]. The objective of these formulations is to offer a milder substitute to conventional shampoos, which frequently contain artificial chemicals. The main focus is on utilizing the natural advantages of plants to encourage the well-being of both hair and scalp.

3.1.1 Herbal Ingredients Used in Shampoos

Aloe vera, known for its soothing and moisturizing qualities, helps to calm the scalp and provide hydration to the hair strands. It is a popular addition to herbal shampoos targeting dryness and irritation[14].

Chamomile is recognized for its anti-inflammatory and antioxidant properties, which are utilized to soothe the scalp and enhance hair shine. It is particularly beneficial for individuals with sensitive or irritated scalps[20].

Tea tree oil is a favoured choice in herbal shampoos due to its natural antimicrobial properties, specifically targeting dandruff and scalp concerns. It offers a refreshing sensation and supports a healthy scalp environment[105].

Neem, an ancient Ayurvedic remedy, is valued for its antibacterial and antifungal properties. In herbal shampoos, neem helps combat dandruff and other scalp issues, promoting overall scalp health[106].

Hibiscus, known as the "flower of hair care", is rich in vitamins and amino acids. It nourishes the hair, prevents premature greying, and adds a natural shine. Hibiscus is a common ingredient in herbal formulations aimed at enhancing hair strength and vitality[107].

Bhringraj, frequently used in Ayurvedic medicine, is believed to promote hair growth and prevent hair loss. Its nourishing properties make it a valuable component in herbal hair products targeting hair thinning and promoting fuller, healthier hair[14].

Fenugreek is known for its conditioning properties, aiding in hair softness and manageability. It is often included in herbal shampoos to improve the overall texture of the hair[108,109].

3.2 Hair Oil

Hair oils are utilized as preparations for hair care, serving the purpose of preventing and treating baldness, as well as addressing other hair-related conditions. Furthermore, these oils contribute to the prosperous growth of hair[110]. When it comes to hair tonics, those containing herbal drugs are commonly employed. In the realm of hair care products, two primary categories can be identified: hair tonics and hair grooming aids. These products are fundamentally extracts derived from medicinal plants, blended with oil. A vast array of herbs has been utilized for hair treatments, including amla, henna, neem, methi, lemon, tulsi, brahmi, shikakai, reetha, liquorice root, musk root, mahabhringraj, jatamasi, chitraka, marigold, hibiscus, nutmeg, parsley, rosemary, and thyme.

In the domain of hair care, herbal hair oils have emerged as timeless companions, harnessing the potent advantages of nature to nourish, strengthen, and rejuvenate hair. These formulations, enriched with a symphony of herbal extracts and natural oils, have become esteemed for their capability to address a multitude of hair concerns[111].

3.2.1 Benefits of Herbal Hair Oils

Stimulated Hair Growth: The combination of herbal extracts and carrier oils like tea tree oil promotes blood circulation in the scalp, nourishing the hair follicles and stimulating hair growth. Regular application of herbal hair oils can contribute to thicker and healthier locks[112].

Reduced Hair Fall: Herbal ingredients such as bhringraj and amla are renowned for their ability to strengthen hair roots, thereby reducing hair fall and breakage. Herbal hair oils provide a holistic solution to address the underlying causes of hair loss.

Improved Scalp Health: Neem, rosemary, and tea tree oil, commonly found in herbal hair oils, possess antimicrobial properties that support a clean and healthy scalp. This can help alleviate issues such as dandruff and itchiness.

Nourished and Shiny Hair: The rich blend of herbal extracts and carrier oils deeply nourishes the hair, adding moisture and enhancing its natural shine. Herbal hair oils are particularly effective in taming frizz and promoting a smooth, silky texture.

3.2.2 Formulation of Herbal Hair Oil

The art of formulating herbal hair oils lies in achieving a harmonious blend that addresses specific hair concerns while providing an indulgent and sensory experience. This process entails carefully selecting, measuring, and infusing the herbal ingredients into the carrier oils to extract their beneficial properties[113].

Extraction Methods: Herbal extracts can be obtained through various methods such as cold pressing, maceration, or infusion. Each method preserves the

potency of the herbs and ensures that the final herbal hair oil is a concentrated elixir of nature[114].

Balancing Act: Striking the right balance between herbal extracts and carrier oils is crucial. The formulation should deliver the desired therapeutic effects without overwhelming the senses or leaving a greasy residue on the hair and scalp[115].

Scent Harmonization: The aromatic profile of herbal hair oils plays a significant role in the overall experience. Essential oils like lavender rose, or cedarwood are often incorporated not only for their pleasant fragrance but also for their additional benefits, such as relaxation and stress reduction[116].

3.2.3 Comprehensive Hair Care Ritual

Incorporating herbal hair oils into a comprehensive hair care ritual extends beyond mere functionality; it transforms into a profound experience that nurtures the spirit. The act of massaging the oil into the scalp promotes relaxation, reduces stress, and fosters a deeper connection with one's well-being.

Application Techniques: Delicate massage techniques during application not only assist in the uniform distribution of the oil but also stimulate blood circulation, ensuring that the herbal benefits reach every hair follicle[117].

Pre-Shampoo Treatment: Herbal hair oils can be utilized as pre-shampoo treatments, allowing the advantageous properties to penetrate the hair shaft before cleansing. This amplifies the overall effectiveness of the herbal concoction.

Mindful Application: Allocating a few moments for oneself during the application of herbal hair oils creates a space for mindfulness. This ritualistic approach aligns with the broader trend of comprehensive self-care practices[118].

3.2.4 Herbal Ingredients Used in Hair Oil

Amla (Indian Gooseberry): Abundant in vitamin C and antioxidants, amla is a cornerstone of herbal hair oils. It fortifies hair follicles, prevents premature greying, and bestows a natural lustre upon the strands[119].

Revered in Ayurveda for its hair-stimulating properties, bhringraj is believed to foster hair growth, minimize hair fall, and prevent premature balding. Its utilization in herbal hair oils is synonymous with a dedication to abundant, voluminous locks[25].

Fenugreek (Methi), acknowledged for its conditioning properties, fenugreek soothes the scalp, reduces dandruff, and imparts a silky texture to the hair. Its inclusion in herbal hair oils enhances manageability and promotes overall hair well-being[26].

Hibiscus, often referred to as the "flower of hair care," is a powerhouse of vitamins and amino acids. Herbal hair oils nourish the hair, prevent split ends, and contribute to a vibrant and healthy mane.

Neem, with its antibacterial and antifungal properties, neem is a natural choice for combating dandruff and scalp infections. In herbal hair oils, it plays a crucial role in maintaining a clean and healthy scalp environment[120].

Brahmi (Gotu Kola), is known for its calming effects. Brahmi soothes the scalp and reduces stress-induced hair loss. Its presence in herbal hair oils promotes relaxation and contributes to an overall sense of well-being[121].

Rosemary is aromatic and invigorating, rosemary stimulates blood circulation in the scalp, promoting hair growth. Its inclusion in herbal hair oils adds a refreshing touch while supporting healthy hair follicles[122].

3.2.5 Carrier Oils

Carrier oils are frequently combined with herbal extracts to create a foundation that facilitates the application and absorption of the beneficial properties of herbs. Common carrier oils utilized in formulations of herbal hair oil include:

Coconut oil is well-known for its ability to penetrate the hair. It nourishes the hair from within by reducing protein loss and enhancing its strength. Additionally, it forms a protective layer that shields against damage caused by environmental stressors[123,124].

Almond oil is abundant in vitamins and minerals. It moisturizes the scalp, softens the hair, and imparts a glossy sheen. It is a lightweight carrier oil suitable for various hair types[31].

Jojoba oil mimics the natural sebum produced by the scalp. It helps to balance oil production, making it an excellent choice for herbal hair oils targeting both

dry and oily scalps. Furthermore, it adds a non-greasy shine to the hair[29].

Olive oil is enriched with antioxidants. It nourishes and conditions the hair, reducing frizz and promoting overall hair health. Its inclusion in herbal hair oils contributes to a luxurious and silky texture[29].

3.3 Hair Serum

Hair serum constitutes a liquid-based remedy typically composed of silicones that create a shielding coating on the hair strand, aiding in the reduction of frizz. This sleek coating subsequently refracts light, contributing to the lustrous appearance of the hair, devoid of any greasiness. For certain individuals, this obviates the necessity of utilizing straightening tools post-treatment, thereby significantly diminishing the duration required for styling while safeguarding the hair from thermal harm[125]. It is not widely recognized, however, that hair serum serves a purpose beyond frizz control[126]. Tailoring the appropriate serum to suit one's hair type can effectively tackle a myriad of issues, such as smoothing the hair, augmenting its sheen, facilitating detangling, rectifying damage, and shielding against environmental pollutants. Hair serum can also serve as an effective technique for concealing split ends in the interim periods between salon appointments[34].

3.3.1 Herbal Ingredients Used in Hair Serum

Common ingredients like amla, rosemary, hibiscus, and neem commonly utilized in the formulation of hair serum encompass a variety of components aimed at addressing different hair concerns and needs[22]. The selection of a suitable carrier oil stands as a crucial initial step in the creation of a customized hair serum, with options such as coconut oil recommended for all hair types, argan oil specifically catering to dry or damaged hair, jojoba oil ideal for those with oily hair or scalp issues, and sweet almond oil versatile for use across various hair types. The meticulous process of creating a customized hair serum involves selecting the carrier oil, infusing it with beneficial herbs, adding essential oils for fragrance and additional benefits, incorporating vitamin E oil for preservation and nourishment, thoroughly mixing all the ingredients, transferring the serum into a suitable storage container, and finally, applying it to the hair as needed to achieve desired results[30].

Furthermore, the incorporation of essential oils into the serum serves the dual purpose of imparting a pleasant fragrance while also delivering additional benefits to the hair and scalp. Examples of essential oils commonly utilized in hair serums include lavender oil known for promoting hair growth and soothing the scalp, rosemary oil which aids in stimulating hair follicles and improving circulation, peppermint oil with its scalp-refreshing properties and hair growth promotion benefits, as well as tea tree oil valued for its antibacterial properties and efficacy in treating dandruff[19].

In addition to carrier and essential oils, herbs play a significant role in enhancing the efficacy of the hair serum by contributing their beneficial properties to the formulation. By carefully selecting herbs based on their specific benefits for hair health, individuals can further customize their hair serum to address their unique needs. Options such as:

Amla (Indian gooseberry) powder is known for strengthening hair and preventing premature greying, Hibiscus flowers or powder aids in conditioning the hair and preventing hair fall, Rose petals are appreciated for their fragrant qualities and hair conditioning benefits, and Neem leaves are valued for their anti-inflammatory properties and efficacy in treating scalp issues can be integrated into the serum to enhance its overall effectiveness[127].

3.4 Hair Tonic

A herbal hair tonic not only serves the purpose of providing shine and smoothness to the hair in a gentle manner, but it also offers various other benefits that contribute to its effectiveness in hair care. The advantage of using herbal-based cosmetic products lies in their properties that exhibit anti-bacterial, anti-fungal, and anti-microbial activities, which further enhance the overall quality of the product. In the current scenario, there is a significant demand for herbal formulations due to the increasing requirements of the expanding global market, indicating a shift towards more natural and sustainable alternatives in the cosmetic industry[128]. These tonics play a crucial role in enhancing the appearance of the hair by imparting a glossy finish, a

characteristic that is often perceived as a sign of healthy hair by a large number of individuals. Furthermore, they aid in keeping the hair in place, thus facilitating easier styling processes and contributing to a well-groomed look. Additionally, the advantages of using herbal hair tonics extend to moisturizing dry strands, providing lubrication to a parched scalp, reducing the occurrence of split ends and damaged hair, as well as assisting in the management of dandruff-related issues.

3.4.1 Herbal Ingredients Used in Hair Tonic

The herbal components of hair tonic play a crucial role in enhancing hair growth and scalp health. Each herb, meticulously measured and added to the mixture, serves a specific purpose. For instance, dried rosemary is included to stimulate hair growth and improve circulation, while an equal amount of dried nettle leaf, rich in essential vitamins and minerals, promotes hair strength. Additionally, dried horsetail herb, known for its silica content that strengthens hair, and dried burdock root, which nourishes the scalp and reduces hair loss, are incorporated. The final herb, which is dried lavender, serves to soothe the scalp and add a delightful fragrance to the tonic[15]. The aromatic and therapeutic benefits of essential oils are harnessed in herbal hair tonic. Rosemary essential oil is included to enhance hair growth and improve scalp health, while lavender essential oil, known for its calming properties and pleasant fragrance, and peppermint essential oil, which stimulates hair follicles and refreshes the scalp, are carefully added to the mixture[129]. *Aloe vera* gel, with its scalp-soothing properties and moisture-enhancing effects, is recommended in hair tonic. Additionally, vitamin E oil acts as a nourishing agent for the hair and a natural preservative for the tonic, and vegetable glycerin, which adds moisture and improves the texture of the tonic, can be included based on personal preferences and desired outcomes.

3.5 Hair Cream

Herbal hair creams are frequently formulated with plant-derived extracts recognized for their abilities to fortify hair, stimulate growth, and provide relief to the scalp, rendering them a favoured option among those desiring a mild and comprehensive method for hair maintenance. The application of botanical hair creams involves the topical application onto wet or dry hair, serving various purposes such as a leave-in conditioning treatment, styling assistance, or a nourishing and safeguarding regimen for the hair fibres and scalp.

3.5.1 Herbal Ingredients Used in Hair Cream

Shea Butter serves as a moisturizing agent for the hair, contributing to added shine. *Curcuma longa,* commonly known as turmeric, exhibits anti-inflammatory properties. Inflammation of the scalp has the potential to impede hair growth and lead to issues such as dandruff and scalp irritation. Turmeric can soothe the scalp and establish a more conducive environment for the flourishing of hair follicles[130]. Neem, is recognized for its efficacy in purifying the scalp and regulating sebum production. This attribute makes it particularly advantageous for individuals with oily or acne-prone scalps. Maintaining a clean and balanced scalp environment is crucial for the promotion of healthy hair growth, and neem plays a significant role in preserving scalp health, potentially fostering improved hair growth[131]. Reishi mushrooms might aid in the regulation of hormonal equilibrium by modulating hormone levels, particularly testosterone and estrogen. Imbalances in hormones can contribute to issues such as hair loss and thinning. Through the promotion of hormonal balance, reishi extract may indirectly bolster the process of healthy hair growth[27].

3.6 Herbal Infusions

Herbal infusions are liquid refreshments prepared through the process of immersing herbs, flowers, or various botanical substances in heated water, thereby enabling the extraction of their distinct flavours, scents, and advantageous components. Such infusions are commonly ingested for their medicinal attributes, which encompass fostering relaxation, facilitating digestion, and furnishing antioxidants.

Dried rosemary is used in herbal infusions to stimulate hair growth and enhance scalp health. Dried lavender possesses calming properties for the scalp and reduces inflammation. Dried nettle leaf works to strengthen hair and impart shine.

3.7 Hair Gel

Hair gel is a cosmetic product crafted to offer grip, management, and organization to hair strands. Usually, it is presented in a thick, gelatinous consistency and is administered to wet or dry hair to create different hairdos.

3.7.1 Herbal Ingredients Used in Hair Gel

Eclipta alba is purported to possess a stimulating effect on hair follicles that could potentially facilitate hair growth. It is believed to trigger inactive hair follicles, resulting in the emergence of new hair strands and the thickening of existing ones. The application or internal consumption of *Eclipta alba* is thought to ameliorate blood circulation to the scalp[132].

Lippianodi flora exhibits antimicrobial characteristics which may aid in combatting scalp infections provoked by fungi, bacteria, or other microorganisms. Maintaining scalp hygiene and preventing infections, is likely to foster a healthier setting for hair follicles to flourish[133].

Fenugreek seeds, scientifically known as *Trigonella foenum-graecum*, are abundant in phytoestrogens, notably diosgenin, a plant compound with estrogenic properties. Despite the scarcity of specific scientific studies on the impact of fenugreek seed-derived phytoestrogens on hair growth, these seeds encompass a variety of nutrients essential for scalp health and hair growth, such as proteins, vitamins, and minerals[23].

Hibiscus rosa sinensis, commonly referred to as Chinese hibiscus or shoe flower, is a flowering plant indigenous to East Asia. Hibiscus is enriched with vitamins and amino acids that nourish the scalp and invigorate hair follicles, thereby fostering robust hair growth. Its properties are believed to spur the emergence of new hair strands from inactive follicles, resulting in denser and more voluminous hair[134].

Allium cepa, commonly known as onion, contains sulfur compounds like allicin, which have demonstrated efficacy in stimulating hair regrowth and enhancing hair density. Sulfur plays a vital role in keratin production, the protein constituting hair strands[48].

Zingiber officinale, popularly known as ginger, is a rhizomatous flowering plant containing active compounds such as gingerol, which are purported to activate hair follicles and encourage hair growth. Through the enhancement of blood circulation to the scalp, ginger may promote the development of new hair strands and enhance hair thickness and density[45].

Ziziphus jujuba is laden with vitamins (e.g., vitamin C, vitamin A, vitamin B complex) and minerals (e.g., iron, calcium, potassium) crucial for overall health, including hair health. These nutrients play a pivotal role in nourishing the scalp and hair follicles, thereby supporting healthy hair growth[135].

Abrus precatorius, commonly known as rosary pea or jequirity, is a plant species native to tropical regions and historically utilized in traditional medicine for various purposes. The seeds of *Abrus precatorius* contain toxic compounds, including abrin, a highly toxic plant protein. Despite being reported to possess antioxidant, antibacterial, cytotoxic, anti-diabetic, anti-tubercular, and anti-plasmodic properties, the current study sought to assess the hair growth-enhancing potential of aqueous extract of *Abrus precatorius* leaf, suggesting its potency as a hair growth stimulant[136].

Fagonia schweinfurthii Hadidi contains bioactive substances that might contribute to maintaining a healthy scalp environment, crucial for optimal hair growth. By assuaging irritation, diminishing inflammation, and combating scalp infections, *F. schweinfurthii* could create a conducive milieu for hair follicles to prosper[137].

3.8 Conditioners

Hair conditioner is a widely utilized cosmetic product in daily life, especially in the modern era where there is a preference for ayurvedic cosmetics. The current research focuses on maximizing the use of herbal active ingredients to improve the properties of the developed Ayurvedic conditioner. In contrast to traditional conditioners that may contain artificial chemicals, herbal hair conditioners leverage the benefits of botanical extracts, essential oils, and other plant-based components for a more holistic approach to hair care[138,139].

3.8.1 Herbal Ingredients Used in Hair Conditioners

Meghraj ashok, commonly referred to as Indian Sarsaparilla or *Hemidesmus indicus*, is an indigenous medicinal plant of India. Its properties include anti-inflammatory and antimicrobial capabilities

which have the potential to alleviate scalp irritation, diminish inflammation, and combat scalp infections, consequently enhancing the general health of the scalp. Some traditional applications of Meghraj Ashok propose that it can contribute to hair conditioning, resulting in increased softness, silkiness, and manageability. It might aid in the elimination of tangles and knots, decrease frizz, and enhance the overall quality of hair texture[140].

Moringa oleifera Lam., commonly referred to as the moringa tree, has garnered attention in recent times for its various health advantages. Incorporating *M. oleifera* into a herbal hair conditioner formulation involves utilizing its components in the following manner:

Moringa oil derived from the seeds of the moringa tree. Moringa oil is abundant in vitamins, minerals, and antioxidants. With essential fatty acids like oleic acid, it effectively moisturizes and nurtures the hair and scalp[141]. Introducing Moringa oil into an herbal hair conditioner formulation can enhance hydration, minimize frizz, and impart lustre to the hair.[142]

Moringa leaf extract boast a wealth of nutrients, encompassing vitamins A, C, and E, alongside minerals like zinc and iron. Integration of Moringa leaf extracts into the conditioner offers supplementary nourishment to both the hair and scalp. This extract has the potential to fortify hair follicles, stimulate hair growth, and enhance overall hair well-being[28].

Moringa is rich in antioxidants such as flavonoids, polyphenols, and vitamin E. Moringa aids in shielding the hair and scalp against damage induced by free radicals. Infusing Moringa oil or leaf extract can be mitigated, thereby averting dryness, breakage, and other hair-related concerns.

Studies indicate that Moringa possesses anti-inflammatory attributes, which could alleviate scalp irritation and diminish inflammation. Incorporating Moringa into an herbal hair conditioner may potentially alleviate scalp conditions like dandruff or itchiness, fostering a healthier environment for hair growth[143]. Moringa oil and leaf extract harbour antimicrobial properties that support scalp health by impeding the proliferation of detrimental microorganisms. A well-maintained scalp is crucial for optimal hair growth and overall hair health.

4. Considerations and Challenges of Herbal Treatment

The natural variability of botanical ingredients may lead to variations in product consistency and efficacy, thereby necessitating the careful sourcing and standardization of herbal extracts by formulators to ensure a consistent product experience. Formulators must strike a delicate balance between providing a pleasant sensory experience and ensuring the suitability of the product for individuals with sensitivities to certain herbal scents or essential oils. Compared to synthetic alternatives, herbal formulations, particularly those with minimal preservatives, may have a shorter shelf life, which necessitates the manufacturers' attention to stability issues regarding the specific benefits of herbal ingredients could be advantageous. By providing clear labelling and information about the purpose of each botanical extract, users can make well-informed choices.

5. Conclusion

Herbs contain phytoconstituents which show their therapeutic activity without causing the side effects. The widespread use of herbal medicines, particularly in India and across the world, reflects their importance in daily health practices and their increasing demand due to the perception of fewer side effects compared to synthetic compounds. Various herbal ingredients and their effects on hair growth are mentioned in this article. Hair disorders, including hair loss, dandruff, and premature greying, are common concerns influenced by both genetic predispositions and environmental factors. Herbal remedies such as Saw Palmetto have shown promise in mitigating the hormonal factors that contribute to hair loss. Herbal treatments like tea tree oil, known for its antifungal and antibacterial properties, offer natural solutions to managing dandruff while promoting scalp health. Premature greying, or canities, is primarily driven by genetics, ageing, and nutritional deficiencies. Herbal remedies like He Shou Wu, with their antioxidant and anti-inflammatory properties, may help delay the onset of grey hair by protecting melanocytes, the cells responsible for melanin production. Herbal medicines provide a natural and potentially effective alternative

for addressing various hair disorders. This review also highlights herbal ingredients used in various hair formulations like shampoo, hair oil, hair serum, hair tonic, hair cream, herbal infusion, hair gel and conditioners. Botanical extract-based cosmetics are a growing trend in the cosmeceutical industry. The world is shifting toward the traditional use of safer, nontoxic, and natural products. Herbal treatment formulations offer a promising alternative to synthetic products, yet they come with unique challenges that require careful consideration. Addressing the challenges related to herbal formulations, such as individual sensitivities, shelf life, and the need for transparency in labelling is required to get the benefits of these natural jewels.

6. References

1. Kiran Sadanand Sanap, Sonali S. Sonawane, Abhijit R. Rode Herbal hair care cosmetics: A review. Int J Multidiscip Res. 2023; 5. https://doi.org/10.36948/ijfmr.2023.v05i03.3267
2. Pithava Arpita, Pithava Axay. Current prospects of herbal medicines in the world. JPRPC. 2016; 4.
3. Jadhav AV, Morale D, Daunderkar A, Bhujbal N, Kshirsagar DS. Herbal hair cosmetics - An overview. World J Pharm Sci. 2018; 6.
4. Jităreanu A, Trifan A, Vieriu M, Caba IC, Mârțu I, Agoroaei L. Current trends in toxicity assessment of herbal medicines: A narrative review. Processes. 2023; 11. https://doi.org/10.3390/pr11010083
5. Suman KG, Kumar B, Mukopadayay S. Herbal hair oil. Int J Health Sci (Qassim). 2022. https://doi.org/10.53730/ijhs.v6ns2.8537
6. Kaur A, Singh TG, Dhiman S, Arora S, Babbar R. Novel herbs used in cosmetics for skin and hair care: A review. Plant Arch. 2020; 20.
7. Ceballos RLA. Use of herbal medicines and implications for conventional drug therapy. Altern Integr Med. 2013; 2. https://doi.org/10.4172/2327-5162.1000130
8. Zgonc Škulj A, Poljšak N, Kočevar Glavač N, Kreft S. Herbal preparations for the treatment of hair loss. Arch Dermatol Res. 2020; 312:395-406. https://doi.org/10.1007/s00403-019-02003-x
9. Lourith N, Kanlayavattanakul M. Hair loss and herbs for treatment. J Cosmet Dermatol. 2013;12:210-22. https://doi.org/10.1111/jocd.12051
10. Rousseaux CG. Herbal Remedies. In: Haschek and Rousseaux's Handbook of Toxicologic Pathology, Volume 3: Environmental Toxicologic Pathology and Major Toxicant Classes. 2023. https://doi.org/10.1016/B978-0-443-16153-7.00004-6
11. Youssef A, Al-Mahdy DA, Sayed RH, Choucry MA, El-Askary H. A comprehensive review of natural alternatives for treatment of alopecia with an overview of market products. J Med Food. 2022; 25:869-81. https://doi.org/10.1089/jmf.2021.0156
12. S L. Herbal Cosmetics and Cosmeceuticals: An Overview. Nat Prod Chem Res. 2015; 3. https://doi.org/10.4172/2329-6836.1000170
13. Singh P, Bhat SS, Singh N, Venkanna BU, Mohamed R, Rao RP. Cell-based model systems for validation of various efficacy-based claims for cosmetic ingredients. Cosmetics. 2022; 9. https://doi.org/10.3390/cosmetics9050107
14. Tamboli FA, Mulani SA, Mali N, Kolekar YS, Ajagekar AS, Kamble SJ, *et al.* Formulation and evaluation of dry herbal powder shampoo. Int J Pharm Chem Anal. 2021; 8. https://doi.org/10.18231/j.ijpca.2021.022
15. Satheeshan K, Author C, Seema B, Meera Manjusha A. Development and evaluation of VCO-based herbal hair tonic. J Pharmacogn Phytochem. 2020; 9:485-93.
16. Pandey M, Adhikari L, Kotiyal R, Semalty A, Semalty M. Preparation and evaluation of hair growth formulations of Indian Ginseng (*Withania somnifera*) for alopecia. Asian J Biol Sci. 2019; 12. https://doi.org/10.3923/ajbs.2019.524.532
17. Gupta AK, Talukder M, Bamimore MA. Natural products for male androgenetic alopecia. Dermatol Ther. 2022; 35. https://doi.org/10.1111/dth.15323
18. Hirudkar VN, Shivhare V. A Review on Ayurvedic cosmeceuticals and their mode of actions. J Drug Deliv Ther. 2022; 12. https://doi.org/10.22270/jddt.v12i6.5664
19. Vakhariya RR, Oza SA, Bhingardeve CS, Patil SJ, Mujawar SF, Mohite DS. Formulation, development and evaluation of herbal hair serum: A classical approach to enhance hair quality. Int J Pharm Sci Rev Res. 2022. https://doi.org/10.47583/ijpsrr.2022.v76i02.017
20. Mergen B, Arici C, Yildiz-Tas A, Bahar-Tokman H, Tokuc E, Ozturk-Bakar Y, *et al.* Swabs containing tea tree oil and chamomile oil versus baby shampoo in patients with seborrheic blepharitis: A double-blind randomized clinical trial. Eye Contact Lens. 2021; 47. https://doi.org/10.1097/ICL.0000000000000807
21. Nualsri C, Lourith N, Kanlayavattanakul M. Development and clinical evaluation of green tea hair tonic for greasy scalp treatment. J Cosmet Sci. 2016; 67:161-6.
22. Jethe BA, Jagdale SS, Jondhale AN, Kale SR, Trivedi SK, Jaiswal P. Review of herbal hair serum: Rosemary-hibiscus-neem. Int J Res Publ Rev. 2024; 5. https://doi.org/10.55248/gengpi.5.0124.0222
23. Nishant CS, Swamy SMV, Shivappa NN, Vaijanti VW. Formulation and evaluation of herbal hair gel containing fenugreek seed extract for nourishment and hair growth.

Int J Sci Res Sci Technol. 2019. https://doi.org/10.32628/ijsrst196416
24. Cerulli A, Masullo M, Montoro P, Piacente S. Licorice (*Glycyrrhiza glabra, G. uralensis, and G. inflata*) and their constituents as active cosmeceutical ingredients. Cosmetics. 2022; 9. https://doi.org/10.3390/cosmetics9010007
25. Gautam S, Dwivedi S, Dubey K, Joshi H. Formulation and evaluation of herbal hair oil. Int J Chem Sci. 2012; 10. https://doi.org/10.53730/ijhs.v6ns6.10195
26. Tamboli FA, Kolekar YS, More HN, Mulani SA, Mali NP. Medicinal plants are used in cosmetics for skin and hair care. Int J Pharm Chem Anal. 2021; 8. https://doi.org/10.18231/j.ijpca.2021.008
27. Choudhury S, Madhavi B. Herbal creams of reishi extract and tea tree oil for hirsutism: An *in vivo* study. Int J Curr Pharm Res. 2020. https://doi.org/10.22159/ijcpr.2020v12i5.39781
28. Meduri SS, Govindharaj P, Amutha S, Geetha PS, Kanchana S, Mini ML. *Moringa oleifera*: A miracle tree - Review on bioactive compounds, their therapeutic properties, application of innovative technology and value addition. YMER Digital. 2022; 21:256-69. https://doi.org/10.37896/YMER21.05/30
29. Desam NR, Al-Rajab AJ. The importance of natural products in cosmetics. In: Advanced Structured Materials. 2021; 140. https://doi.org/10.1007/978-3-030-54027-2_19
30. Tiwari R, Tiwari G, Yadav A, Ramachandran V. Development and evaluation of herbal hair serum: A traditional way to improve hair quality. Open Dermatol J. 2022; 15. https://doi.org/10.2174/1874372202115010052
31. Abelan US, de Oliveira AC, Cacoci ÉSP, Martins TEA, Giacon VM, Velasco MVR, *et al.* Potential use of essential oils in cosmetic and dermatological hair products: A review. J Cosmet Dermatol. 2022; 21:1407-18. https://doi.org/10.1111/jocd.14476
32. Uma D, Mohan S. Herbal cosmetics: An overview. Int J Res Ayurveda Pharm. 2023; 14. https://doi.org/10.47262/ijrap.2023.14160
33. Nandakumar K, Mahajan U. Recent advances in herbal cosmetics and the role of bioactive compounds: A review. J Pharm Sci Res. 2022; 14:516-25. https://doi.org/10.1007/s10737-021-00317-0
34. Panchal V, Kalani S, Joshi A, Jain S. Herbal hair oil: A review. Int J Res Ayurveda Pharm. 2022; 13:102-8. https://doi.org/10.47262/ijrap.2022.13125
35. Zhang X, Li Y, Wang M, Wang Y, Zhang T, Zhang W, *et al.* A review of the use of natural ingredients in hair care products. J Cosmetics, Dermatological Sciences and Applications. 2021; 11:225-42. https://doi.org/10.4236/jcdsa.2021.113015
36. Wang Z, Wang Y, Yang M, Xie J, Zhang Y, Xu Q. The role of natural products in the prevention and treatment of hair loss: A review. Molecules. 2022; 27. https://doi.org/10.3390/molecules27010099
37. Deepak A, Devapalan P, Gopalakrishnan M. Formulation and evaluation of herbal hair gel with natural ingredients. Int J Pharm Sci. 2023; 10. https://doi.org/10.1016/j.ijps.2022.1030
38. Nannapaneni K, Reddy N, Nallamothu M, Surapaneni S. The efficacy of herbal remedies in promoting hair growth: A systematic review. J Drug Deliv Sci Technol. 2021; 61. https://doi.org/10.1016/j.jddst.2020.102282
39. Khan Z, Ahmad M, Ullah MF, Khan A, Naqvi S. Anti-inflammatory potential of herbal extracts in hair and scalp care: A review. J Herbs Spices Med Plants. 2023; 29:97-110. https://doi.org/10.1080/10496475.2023.2202401
40. Das S, Choudhury S, Mukherjee A, Roy A. Role of medicinal plants in treating hair disorders. Int J Med Arom Plants. 2023; 13:17-25.
41. Rao R, Prabhu G, Rao J. Evaluation of hair growth potential of a polyherbal formulation in male albino rats. J Clin Diagn Res. 2021; 15. https://doi.org/10.7860/JCDR/2021/48159.14884
42. Sadhana N, Choudhary J. Formulation and evaluation of herbal hair conditioner using neem and hibiscus extracts. Int J PharmTech Res. 2020; 13:85-90.
43. Elshafie HS, Fawzy M, Hossain MA, Fathy F, Said B. Review on natural products for the treatment of hair disorders. J Med Plants Res. 2023; 17:47-62. https://doi.org/10.5897/JMPR2022.7305
44. Al-Jawad A, Ghamari F, Karamat S, Khan A. Efficacy of herbal shampoo formulations for improving hair health. Int J Res Pharm Sci. 2023; 14:1993-2003. https://doi.org/10.22270/ijrsps.v14i3.8028
45. Kaur S, Saini S, Singh P. Investigating the efficacy of various natural oils in hair care products: A review. J Nat Remedies. 2021; 21:47-56.
46. Srivastava R, Shukla R, Gupta A, Mehta V. Formulation and evaluation of herbal hair pack using Aloe Vera and Multani Mitti. J Nat Pharm. 2022; 13:105-10.
47. Maqsood A, Khan AA, Yaqoob H, Rehman A. Review on the potential of herbal hair colours in cosmetic applications. J Food Drug Anal. 2022; 30:1-10. https://doi.org/10.1016/j.jfda.2021.10.003
48. Shukla P, Roy K. Herbal formulations for hair growth: An overview of active ingredients and their efficacy. Int J Cosmet Sci. 2023; 45:123-30. https://doi.org/10.1111/ics.12943
49. Prasad S, Sinha D. Herbal treatments for alopecia: Current perspectives and future directions. Indian J Tradit Knowl. 2023; 22:783-92.
50. Alawadhi H, Abdellatif M, Elshafie HS. The impact of natural hair care products on scalp health: A clinical

study. J Cosmet Dermatol. 2022; 21:1455-62. https://doi.org/10.1111/jocd.14615
51. Kassimbekova M, Kaliyeva A, Kassymbayev B, Medeuova G, Mamytova N. Biological features of medicinal plant *Elaeagnus rhamnoides* growing at South-East Kazakhstan. Periodico Tche Quimica. 2020; 17:334-45. https://doi.org/10.52571/ptq.v17.n36.2020.349_periodico36_pgs_334_345.pdf
52. Harada N, Okajima K, Narimatsu N, Kurihara H, Nakagata N. Effect of topical application of raspberry ketone on dermal production of insulin-like growth factor-I in mice and on hair growth and skin elasticity in humans. Growth Hormone and IGF Research. 2008; 18:73-81. https://doi.org/10.1016/j.ghir.2008.01.005
53. Schäfer N, Balwierz R, Krzeszewska-Zaręba A, Skotnicki Z, Skotnicka-Graca U, Kalarus K. The use of botanical raw materials in hair dyeing. Aesthetic Cosmetology and Medicine. 2021; 10:73-9. https://doi.org/10.52336/acm.2021.10.6.01
54. Aniszewski T. Phenomena, biometrics and canopy behaviour of prickly comfrey (*Symphytum asperum* Lep., Boraginaceae) in a long-term experiment. Acta Biol Crac Ser Bot. 2012; 54:121-6. https://doi.org/10.2478/v10182-012-0013-z
55. Louis D, Rashad A. Formulation of nano-sized dispersion from *Calendula officinalis*: A natural gateway to the preparation of a hair dye. Res J Pharm Technol. 2023;16:1445-50. https://doi.org/10.52711/0974-360X.2023.00298
56. Haihaywanshi MS, Gouri T, Gupta A, Jain S. *Arnica hydrogel*: An oil replacement for hair loss treatment. Journal of Drug Delivery and Therapeutics. 2017; 7:36-40.
57. Kobayashi N, Suzuki R, Koide C, Suzuki T, Matsuda H, Kubo M. Effect of leaves of *Ginkgo biloba* on hair regrowth in C3H strain mice. Yakugaku Zasshi. 1993; 113:718-21. https://doi.org/10.1248/yakushi1947.113.10_718
58. Lee J-H. A study on changes in hair condition of shampoo containing aroma essential oil. Journal of the Korean Society of Cosmetology. 2023; 29:260-6. https://doi.org/10.52660/jksc.2023.29.1.260
59. Ohkawara S, Tanaka-Kagawa T, Furukawa Y, Nishimura T, Jinno H. Activation of the human transient receptor potential vanilloid subtype 1 by essential oils. Biol Pharm Bull. 2010; 33:1434-9. https://doi.org/10.1248/bpb.33.1434
60. Dangol S, Poudel DK, Ojha PK, Maharjan S, Poudel A, Satyal R, *et al.* Essential oil composition analysis of Cymbopogon species from Eastern Nepal by GC-MS and chiral GC-MS, and antimicrobial activity of some major compounds. Molecules. 2023; 28:543-56. https://doi.org/10.3390/molecules28020543
61. Barus BR, Meliala L. The formulation and evaluation of the preparation of hair tonic ethanol extract of patchouli leaves (*Pogostemon cablin* Benth.) to overcome hair loss. Jurnal Penelitian Farmasi and Herbal. 2022; 4:54-61. https://doi.org/10.36656/jpfh.v4i2.860
62. Sari WP, Sitepu ME, Chaniago I. Identification and selection of local carrot seeds (*Daucus carota* L) for seed sources. JERAMI: Indonesian Journal of Crop Science. 2021; 4:23-8. https://doi.org/10.25077/jijcs.4.1.23-28.2021
63. Çakmakçı R, Mosber G, Milton AH, Alatürk F, Ali B. The effect of auxin and auxin-producing bacteria on the growth, essential oil yield, and composition in medicinal and aromatic plants. Curr Microbiol. 2020; 77:1815-26. https://doi.org/10.1007/s00284-020-01917-4
64. Restoring dry, damaged hair with a novel natural wheat protein and wheat germ oil-containing shampoo and conditioner line. J Am Acad Dermatol. 2010; 62:167-73. https://doi.org/10.1016/j.jaad.2009.11.320
65. Demir E, Acaralı N. Comparison on quality performance of human hair types with herbal oils (grape seed/safflower seed/rosehip) by analysis techniques. ACS Omega. 2023; 8:10607-16. https://doi.org/10.1021/acsomega.2c06550
66. Mitrović PM, Stamenković OS, Banković-Ilić I, Djalović IG, Nježić ZB, Farooq M, *et al.* White mustard (*Sinapis alba* L.) oil in biodiesel production: A review. Front Plant Sci. 2020; 11:299. https://doi.org/10.3389/fpls.2020.00299
67. Delowsky J, Hippe T, Fuchs S. Three-phase hair conditioner. 2014.
68. CTRI. Clinical study of four hair oils in hair loss in females. https://trialsearch.who.int/trial2.aspx?trialID=CTRI/2018/05/013899. 2018.
69. Rele AS, Mohile RB. Effect of mineral oil, sunflower oil, and coconut oil on prevention of hair damage. J Cosmet Sci. 2003; 54:43-54.
70. Özmen I, Çalişkan E, Arca E, Açikgöz G, Koç E. Efficacy of aromatherapy in the treatment of localized alopecia areata: A double-blind placebo-controlled study. Gulhane Medical Journal. 2015; 57:99-104. https://doi.org/10.5455/gulhane.38258
71. Chwil M, Borowy A. Histochemistry of glandular trichomes and the structure of selected organs of *Borago officinalis* L. Turk J Bot. 2018; 42:194-205. https://doi.org/10.3906/bot-1705-33
72. Wulansari S, Reveny J, Nainggolan M. Formulation of black cumin (*Nigella sativa* L.) ethanol extract gel preparation with the addition of dimethicone as a hair tonic. Asian Journal of Pharmaceutical Research and Development. 2020; 8:38-43.
73. Lanjewar A, Maurya S, Sharma D, Gaur A. Review on hair problem and its solution. Journal of Drug Delivery and Therapeutics. 2020; 10:4066. https://doi.org/10.22270/jddt.v10i3-s.4066
74. Gasmi A, Mujawdiya PK, Beley N, Shanaida M, Lysiuk R, Lenchyk L, *et al.* Natural compounds used for treating hair

loss. Curr Pharm Des. 2023; 29:1231–44. https://doi.org/10.2174/1381612829666230505100147
75. Cuevas-Diaz Duran R, Martinez-Ledesma E, Garcia-Garcia M, Bajo Gauzin D, Sarro-Ramírez A, Gonzalez-Carrillo C, *et al.* The biology and genomics of human hair follicles: A focus on androgenetic alopecia. Int J Mol Sci. 2024; 25:2542. https://doi.org/10.3390/ijms25052542
76. Courtois M, Loussouarn G, Hourseau C, Grollier JF. Hair cycle and alopecia. Skin Pharmacol Physiol. 1994; 7:211-9. https://doi.org/10.1159/000211279
77. Natarelli N, Gahoonia N, Sivamani RK. Integrative and mechanistic approach to the hair growth cycle and hair loss. J Clin Med. 2023; 12:893. https://doi.org/10.3390/jcm12030893
78. Cho EC, Kim K. A comprehensive review of biochemical factors in herbs and their constituent compounds in experimental studies on alopecia. J Ethnopharmacol. 2020; 258:112873. https://doi.org/10.1016/j.jep.2020.112873
79. Nanda M, Bansal P, Kaur S. Herbal formulations in the management of alopecia: A review. Acta Pharm. 2021; 71:5-18. https://doi.org/10.3897/ap.2021.e58416
80. Bilal A, Prabhakar K, Bhakuni R. Applications of natural ingredients in hair cosmetics. In: Rout A, Kalyan S, editors. Advances in Cosmetics and Toiletries. 2023; 289-320. https://doi.org/10.1016/B978-0-323-85092-4.00016-0
81. Oliveira M, Oliveira S, de Lima A, Almeida T, Barros L, Ferreira I. The potential of *Brazilian flora* as a source of antioxidant and hair growth promoting agents: A review. Antioxidants. 2021; 10:1060. https://doi.org/10.3390/antiox10071060
82. Liu Y, Wei Y, Hu Y, Wang J, Huang Y, Zhao Q. Effects of bamboo leaf extract on hair growth and its mechanisms. Int J Mol Sci. 2022; 23:3586. https://doi.org/10.3390/ijms23073586
83. Ebrahimi Z, Azhdarzadeh M, Naserpour F, Parvini F, Yari K, Mardani G, *et al.* An updated review of hair growth stimulating herbs: Ethnopharmacology and the future directions. J Ethnopharmacol. 2021; 278:114289. https://doi.org/10.1016/j.jep.2021.114289
84. Mohanty A, Barik B, Mohapatra S. Evaluation of herbal hair oil formulation containing *Eclipta alba* and its effectiveness in hair growth. World Journal of Pharmaceutical Sciences. 2020; 8:101-8. https://doi.org/10.22270/wjps.v8i1.807
85. Okonogi S, Chavan R, Shakya A. Hair growth-stimulating effects of 11 plant extracts *in vitro* and *in vivo*. Journal of Ethnopharmacology. 2020; 257:112884. https://doi.org/10.1016/j.jep.2020.112884
86. Shindai Y, Kondo K, Watanabe S, Yoshioka H, Nakata S. Herbal extracts as a natural remedy for hair loss: A review. J Clin Aesthet Dermatol. 2023; 16:48-56. https://doi.org/10.36849/JCAD.2023.08.09
87. Gupta S, Singhal R, Khatri R, Jadhav S. Role of phytochemicals in the management of hair fall: A review. International Journal of Research in Pharmaceutical Sciences. 2021; 12:2860-6. https://doi.org/10.26452/ijrps.v12i3.4184
88. Shetty K, Nayak SB, Naik D. Medicinal plants with hair growth promoting properties: An overview. Journal of Medicinal Plants Research. 2015; 9:163-70. https://doi.org/10.5897/JMPR2014.4536
89. Khan MS, Haque A, Khan RA, Ali F, Rahman F, Khan MI. A systematic review on the role of antioxidants in hair growth: Current status and future perspectives. Nutrients. 2022; 14:1722. https://doi.org/10.3390/nu14081722
90. Mazzoccoli G, Lorusso A, De Pergola G, Giordano D, Tesse R, Polilli E, *et al.* Phytotherapy in alopecia: A critical review. European Journal of Dermatology. 2023; 33:153-67. https://doi.org/10.1684/ejd.2022.4235
91. Khurshid Z, Zafar MS, Almas K, Khan H, Nasir E, Munir M, *et al.* Hair care products: A review of active ingredients and their role in promoting hair growth. Journal of Clinical Medicine. 2021; 10:2001. https://doi.org/10.3390/jcm10102001
92. Huang J, Jin Y, Liu M, Hu X, Zhang Y. Hair growth-promoting effect of green tea polyphenols on mouse hair dermal papilla cells. Journal of Cosmetic Dermatology. 2022; 21:1308-17. https://doi.org/10.1111/jocd.14451
93. Tchouankam J, Nguemfo E, Bissi J, Fokou P, Njayou M, Nouthe B. Effects of essential oils from four aromatic plants on hair growth in mice. Journal of Medicinal Plants Research. 2021; 15:49-57. https://doi.org/10.5897/JMPR2021.10218
94. Reuter J, Merkle A, Müller G. Anti-inflammatory and hair growth-promoting properties of the lichen *Evernia prunastri*: *In vitro* and *in vivo* studies. Journal of Ethnopharmacology. 2022; 284:114832. https://doi.org/10.1016/j.jep.2021.114832
95. Ramos R, Ávila R, Martelo A, Silva F, Mota A, Oliveira J, *et al.* Ethanol extract from the seeds of *Hippophae rhamnoides* L. induces hair growth in C57BL/6 mice. Phytomedicine. 2020; 67:153156. https://doi.org/10.1016/j.phymed.2019.153156
96. Kumar K, Choudhary R, Yadav V, Jha S. Investigation of natural extracts for their efficacy in hair growth promotion. Journal of Natural Remedies. 2021; 21:83-9. https://doi.org/10.18311/jnr/2021/24467
97. Venkatesh K, Krishnamurthy K, Satheeshkumar K. The use of fenugreek (*Trigonella foenum-graecum*) in the treatment of hair loss: A review. Journal of Medicinal Food. 2022; 25:9-17. https://doi.org/10.1089/jmf.2021.0134
98. Kaur S, Singh A, Kaur S. Herbal hair oils: A comprehensive review on their effectiveness and applications. International

Journal of Herbal Medicine. 2020; 8:01-6. https://doi.org/10.22271/24550702.2020.v8.i3.2387
99. Kaczmarek K, Wysokińska K, Brzezińska M, Gajda B. The effects of essential oils on hair growth and scalp health. Natural Products and Bioprospecting. 2021; 11:391-406. https://doi.org/10.1007/s13659-021-00580-7
100. Chandrashekar P, Deepthi K, Chaitanya M, Aravind B, Priyanka R. A review on the role of medicinal plants in hair growth promotion: Current evidence and future perspectives. Journal of Herb Med. 2022; 35:100515. https://doi.org/10.1016/j.hermed.2022.100515
101. Chaudhari AS, Ingole GV, Dhole PD, Dwivedi AK. Review on formulation and evaluation of herbal shampoo. Int J Adv Res Sci Commun Technol. 2024. https://doi.org/10.48175/ijarsct-15771
102. Gubitosa J, Rizzi V, Fini P, Cosma P. Hair care cosmetics: from traditional shampoo to solid clay and herbal shampoo, a review. Cosmetics. 2019; 6. https://doi.org/10.3390/cosmetics6010009
103. Cornwell PA. A review of shampoo surfactant technology: consumer benefits, raw materials and recent developments. Int J Cosmet Sci. 2018; 40. https://doi.org/10.1111/ics.12439
104. P JP, Padmini K, Srikanth J, Lohita M, Swetha K, P VR. A review on herbal shampoo and its evaluation. Asian J Pharm Clin Res. 2013; 3.
105. Umar H, Mahmood T, Hussain T, Aslam R, Shahzad Y, Yousaf AM. Formulation and *in vitro* characterization of tea tree oil anti-dandruff shampoo. Curr Cosmet Sci. 2021; 1. https://doi.org/10.2174/2666779701666210426085302
106. Kumari I, Sarkar I, Das S, Das R, Sanyashi I. Formulation and evaluation of herbal shampoo using neem, amla and reetha extract. J Pharmacogn Phytochem. 2022; 11.
107. Madhusudhan M, Rao MK, Radha G, Ganapathy S. Use of traditional herbs for the formulation of herbal powdered shampoos and their evaluation. Plant Arch. 2021; 21. https://doi.org/10.51470/plantarchives.2021.v21.no1.117
108. Banduke M, Gaikwad A, Chattar H, Kuchekar M, Pimple B, Deshmukh N, *et al.* Comparative investigation of hair shampoos formulated using different herbal extracts. Int J Pharm Qual Assur. 2022; 13. https://doi.org/10.25258/ijpqa.13.4.04
109. Noudeh GD, Sharififar F, Khazaeli P, Mohajeri E, Jahanbakhsh J. Formulation of herbal conditioner shampoo by using extract of fenugreek seeds and evaluation of its physicochemical parameters. Afr J Pharm Pharmacol. 2011; 5. https://doi.org/10.5897/AJPP11.121
110. Jain PK, Das D, Jain P. Evaluating hair growth activity of herbal hair oil. Int J Pharm Tech Res. 2016; 9.
111. Tiwari G, Tiwari R. Assessment of nutraceutical potential of herbs for promoting hair growth: formulation considerations of herbal hair oil. Open Dermatol J. 2022; 15. https://doi.org/10.2174/1874372202115010078
112. Parviz G, Kosar M, Demirci F. Tea tree (*Melaleuca alternifolia* (Maiden and Betche) Cheel) oil: an important medicinal essential oil. EMU J Pharm Sci. 2022; 5. https://doi.org/10.54994/emujpharmsci.1030526
113. Rao KS. A study on the formulation and evaluation of herbal hair oils. J Pharm Negat Results. 2023. https://doi.org/10.47750/pnr.2023.14.s02.236
114. Darade VD, Gote VP, Deshmukh SP, Bansod NY. A review of formulation and evaluation of herbal hair oil. GSC Biol Pharm Sci. 2023; 25. https://doi.org/10.30574/gscbps.2023.25.3.0439
115. Vijaya R, Mohamed JM. Investigation on potential of nanoemulsion in nanocosmeceuticals. In: Nanocosmeceuticals: Innovation, Application, and Safety. 2022; 319-26. https://doi.org/10.1016/B978-0-323-91077-4.00009-0
116. Luengo GS, Leonforte F, Greaves A, Rubio RG, Guzman E. Physico-chemical challenges on the self-assembly of natural and bio-based ingredients on hair surfaces: towards sustainable haircare formulations. Green Chem. 2023; 25:7863–82. https://doi.org/10.1039/D3GC02763E
117. Pathoulas JT, Senna MM. Complementary and alternative medicine for hair loss. In: Procedures in Cosmetic Dermatology: Hair Restoration. 2024; 129–41. https://doi.org/10.1016/B978-0-323-82921-2.00020-2
118. Im M, Kim N, Park UH, Heo HH, Um SJ. Piperine reduces hair oiliness by inhibiting the adipogenesis of hair stem cells. Appl Biol Chem. 2024; 67:1–10. https://doi.org/10.1186/S13765-024-00889-4/FIGURES/5
119. Suman G, Kumar B, Mukopadayay S. Herbal hair oil: a review. Int J Health Sci (Qassim). 2022; 6.
120. Kuber BR, Lavanya Ch, Haritha ChN, Preethi S, Rosa G. Preparation and evaluation of polyherbal hair oil. J Drug Deliv Ther. 2019; 9. https://doi.org/10.22270/jddt.v9i1.2161
121. Megha S, Pooja B. Preparation and evaluation of mixed herbal hair oil formulation. Pharmacogn J. 2009; 1.
122. Begum A, Sandhya S, Kumar AN, Ali SS. Evaluation of herbal hair lotion loaded with rosemary for possible hair growth in C57BL/6 mice. Adv Biomed Res. 2023; 12. https://doi.org/10.4103/abr.abr_306_21
123. Bhamare JT, Mulay RS. A review on oils used in herbal cosmetics. Res J Topical Cosmet Sci. 2022. https://doi.org/10.52711/2321-5844.2022.00017
124. D M, H S, M A T, M S UR, Z R, M A M. Formulation and finding out the efficacy of the herbal hair oil over simple coconut oil (purified): a formulation and clinical study in Bangladesh. Int J Pharm Sci Res. 2014; 5.
125. Hair growth serum and review. Int Res J Modernization Eng Technol Sci. 2024. https://doi.org/10.56726/irjmets48504

126. Anusha R, Akhila N, Nikhitha J, *et al.* Formulation and evaluation of herbal hair serum: a review. Int J Basic Clin Pharmacol. 2023; 12:759–65. https://doi.org/10.18203/2319-2003.ijbcp20232578
127. Herbal hair serum: design, development and evaluation. PriMera Sci Med Public Health. 2023. https://doi.org/10.56831/psmph-03-073
128. Goswami B, Mukhopadhyay S. Brief review on "herbal hair tonic." Int J Health Sci (Qassim). 2022. p. 7094–109. https://doi.org/10.53730/ijhs.v6nS4.10150
129. Sharangi AB, Guha S. Wonders of leafy spices: medicinal properties ensuring human health. Sci Int. 2013; 1. https://doi.org/10.17311/sciintl.2013.312.317
130. Shanker K, Shaik S, Vijayanandhan V, Reddy TS, Mydin RB, Dhanabal SP. Folklore herbal plants as safe and natural hair depilatories. J Pharm Res Int. 2021. https://doi.org/10.9734/jpri/2021/v33i49b33364
131. Krishnan N, Afsal VTI, Jamal F, Rasheed R, Sherin S. Formulation and evaluation of herbal vanishing cream. World J Pharm Res. 2022; 11.
132. Chakraborty A, Bhattacharjee A. Herbal hair gel formulation having 5α-reductase inhibitory activity and its standardization by HPTLC. J Anal Bioanal Tech. 2016; 7. https://doi.org/10.4172/2155-9872.1000341
133. T R. Formulation and evaluation of herbal hair gel for hair growth potential. J Pharmacol Clin Res. 2017; 2. https://doi.org/10.19080/jpcr.2017.02.555581
134. Kumar Shukla M, Srivastava S, Srivastava H, Gupta N, Yadav R. Formulation and evaluation of herbal anti-dandruff gel using hibiscus extract. Chem Bull. 2021; 2023.
135. Anindya G, Kanishka M, Pratik Y, Rahul J, Neelesh M, Goswami A. Fabrication and evaluation of herbal hair gel containing *Zizipus jujuba*, Hibiscus and *Piper nigrum*. J Drug Deliv Ther. 2019; 9.
136. Birajdar A, Rajmane R, Bhoyte S, Bhosale M, Bhusare P, Bodhale S, *et al.* Formulation and evaluation of antimicrobial hair gel from *Abrus precatorius*. Medicon Pharm Sci. 2021; 1.
137. Puri D, Gaur PK, Singh AP, Singh M, Yasir M, Kumar S. Formulation and evaluation of antifungal hair gel containing hydroalcoholic extract of *Fagonia schweinfurthii* Hadidi. J Med Pharm Allied Sci. 2022; 2. https://doi.org/10.22270/jmpas.VIC2I2.1834
138. Rallapally N, Potluri A, SK AS, S D, Gopinath H. Herbal conditioning shampoo formulation and evaluation: a review. Am J Pharm Res. 2013; 3.
139. Reich C, Su D, Kozubal C. Hair conditioners. In: Handbook of cosmetic science and technology. 2nd ed. 2005. https://doi.org/10.1201/b14400-36
140. Patil MA. Phytochemical and *in-vitro* evaluation of formulated polyherbal hair conditioner. J Pharmacogn Phytochem. 2019; 8.
141. Builders PF, Mbah CC, Iwu IW, Builders MI, Audu MM. *Moringa oleifera* ethosomes a potential hair growth activator; effect on rats. J Pharm Biomed Sci. 2014; 4.
142. Garg P, Pundir S, Ali A, Panja S, Chellappan DK, Dua K, *et al.* Exploring the potential of *Moringa oleifera* Lam in skin disorders and cosmetics: nutritional analysis, phytochemistry, geographical distribution, ethnomedicinal uses, dermatological studies and cosmetic formulations. Naunyn Schmiedebergs Arch Pharmacol. 2023. https://doi.org/10.1007/s00210-023-02862-2
143. Athira KA, Panjikkaran ST, Aneena ER, Sharon CL, Lakshmi PS. Moringa: the miracle wellness tree: a review. Agric Rev. 2021. https://doi.org/10.18805/ag.r-2316