



DEVELOPMENT AND EVALUATION OF MULTIPURPOSE HAIR OIL

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Abstract : Hair care is an integral part of personal grooming, with a growing demand for products that combine functionality and natural ingredients. This project focuses on the development and evaluation of a multipurpose hair oil that addresses common hair and scalp issues such as dryness, dandruff, hair fall, and lack of shine and treatment of diseases related to microbial and fungal infection. The formulation integrates natural oils and bioactive ingredients with proven efficacy in hair care, including coconut oil, castor oil, sesame oil and herbs like Kapoor, coffee, mehndi etc.

1. Introduction

1.1 Introduction to herbal medicine

Herbal medicine Any medicine obtained exclusively from plant raw materials, the effectiveness, side effects and toxicity are well known, as well as the reproducibility and consistency of its quality. Its effectiveness and safety are proven by ethnopharmacological studies on traditional use, technical and scientific documentation or by phase 3 clinical trials that include in its composition an isolated substance of any origin cannot be considered herbal medicines. Herbal medicine is still the basis of primary health care for about 75-80% of the world's population, especially in developing countries. This is mainly due to the general belief that herbal medicines are free of side effects, in addition to being cheap and available locally. According to the World Health Organization (WHO), the use of herbal medicines in the world exceeds two to three times that of conventional medicines. [1][2]

Medicines and their preparations have been widely used for thousands of years in developing countries and developed because of their natural origin and fewer side effects. These medicines initially took the form of raw medicines such as tinctures, teas, poultices, powders and other herbal preparations. Herbal medicines are those that are historically used in a local community or region and are well known from long-term use by the local population in terms of composition, treatment and dosage. They can be used freely by the local community or in the local region. However, if medicines of this category enter the market or leave the local community or region, they must meet the safety and efficacy requirements in accordance with national regulations for herbal medicines.[2]

Herbal medicines have been used for a long time and are documented with their specific theories and concepts accepted by countries. For example, Ayurveda, Unani and Siddha. Modified herbal medicines are altered in their form, including dosage, dosage form, mode of administration, herbal medicinal ingredients, preparation methods and medical indication. It must meet national regulatory requirements for the safety and efficacy of herbal medicines. Imported herbal medicinal products covers all imported herbal medicines, including raw materials and products. Imported herbal medicines must be registered and marketed in the countries of origin. Safety and efficacy data must be submitted to the national authority of the importing country and must meet the safety and efficacy requirements of the herbal medicine regulations in the host country.

In Ayurvedic medicine, herbs are used as an integral part of the health system. In addition to health care, herbs are also used for the beauty of the body and to prepare various cosmetic and coloring products.[3]

1.2 Advantages and disadvantages of herbal medicine

1.2.1 Advantages of Herbal Medicines

- Herbal medicines are very good compared to the conventional form of medicine. This is something that every pocket can afford, unlike other forms of medicine that can burn a big hole in your wallet.[4]
- Herbal medicines can be consumed without the help of any prescription. They can be found very easily at a local pharmacy.

- Herbal medicines are known to be more effective than other forms of medicine in curing some diseases. If they are not mixed with other chemical ingredients, they are known to be completely natural.
- One of the greatest benefits associated with herbal medicine is the lack of side effects. In addition, they tend to provide lasting benefits in terms of overall well-being.[6]
- Obesity is a growing problem that is known to have dangerous consequences on the health of the individual. Herbal medicine can help treat the problem of obesity very effectively without taking much time and effort.
- Although the benefits outweigh the harms, herbal medicine also carries some risks. Let's take a look at the disadvantages.

1.2.2 Disadvantages of Herbal Medicines

- Medicinal plants are known to be ineffective against serious conditions.
- In some cases, individuals turn to herbal remedies without realizing that the symptoms may be related to another illness.[5]
- Unlike conventional medications that involve constant monitoring of your health, herbal medications are taken without a prescription, which means that in some cases a person can undergo a process of trial and error with their medications.

2. Aim and Objective

2.1 Aim:

“Development and evaluation of multipurpose hair oil”

2.2 Rationale

2.2.1 Why herbal oil?

The use of herbal oils in the development of multipurpose hair oil combines traditional wisdom with modern science, addressing a broad spectrum of hair concerns. This not only caters to consumer demand for natural, effective solutions but also ensures a holistic approach to hair care. The evaluation phase can focus on their efficacy, compatibility, and consumer acceptability to ensure the product's success in the market.

2.2.2 Why this formulation?

This formulation is studied and developed by my great-grandfather . Which we have been using in our family for last couple of decades. I also found a journal of my grandfather which documented various ingredients. Which we can use for the formulation of this oil.

2.3 Objective of present work:

1. **Formulation of a Natural and Multifunctional Hair Oil:** To develop a hair oil utilizing natural ingredients with proven benefits for hair care, including moisturizing, nourishing, strengthening, and improving overall scalp health.
2. **Selection and Standardization of Ingredients:** To identify and use bioactive components from natural sources (e.g., castor oil, coconut oil, almond oil, neem oil) that are rich in vitamins, antioxidants, and fatty acids beneficial for hair and scalp.
3. **Optimization of Formulation:** To determine the ideal ratio and combination of oils and additives for maximum efficacy and stability, ensuring user safety and product effectiveness.
4. **Evaluation of Therapeutic Efficacy:** To assess the hair oil's effects on hair texture, growth rate, scalp condition, and reduction of common hair problems through laboratory and user trials.
5. **Compliance with Quality Standards:** To ensure the product meets dermatological safety standards and is free from harmful chemicals, ensuring suitability for various hair types.
6. **Sustainability and Market Feasibility:** To design the product with sustainable sourcing of ingredients and assess its potential for large-scale production and market acceptance.
7. **Promotion of Ancient and Modern Synergies:** To integrate traditional knowledge of herbal hair care with modern scientific techniques to create a unique, effective, and marketable hair oil formulation.

3. Literature review

3.1 Hair and scalp

3.1.1 Hair structure

Hair is a vital aspect of the body, serving as protective appendages and an accessory structure of the integument, along with the sebaceous and sweat glands. The fundamental components of hair include the bulb, root, and shaft. Common issues related to hair include hair fall, dandruff, lice, split ends, and grey hair. Although a piece of hair may appear simple, it is actually one of the most intricate structures in the body. Hair consists of two primary structures: the hair follicle, where hair originates and is anchored, and the stocking-like structure that begins in the epidermis and extends into the dermis.[7]

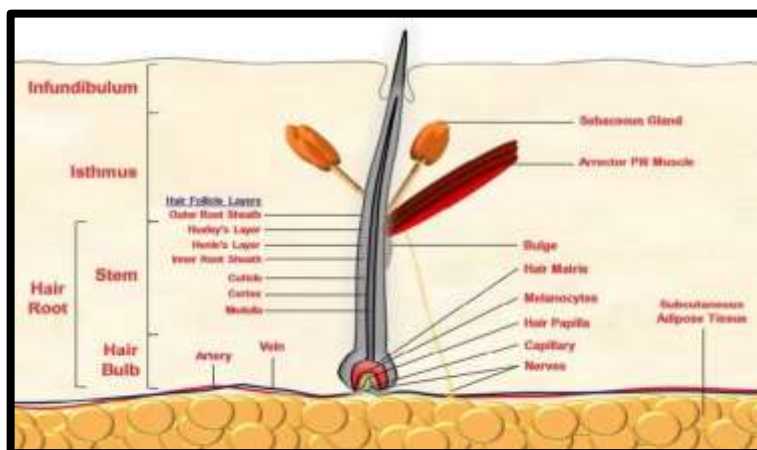


Figure 1 hair structure

3.1.2 Hair shaft

The hair shaft consists of three layers of keratin: the inner layer, also known as the medulla, which may not always be present depending on the type of hair; the middle layer, called the cortex, which forms the majority of the hair shaft; and the outer layer, known as the cuticle, composed of tightly packed scales in an overlapping structure resembling roof shingles.[8]

3.1.3 Hair types

The curl pattern of hair primarily determines its type, which is influenced by the hair follicle. Genetics play a key role in determining hair type, and Andre Walker, Oprah Winfrey's stylist, is known for creating a system that categorizes hair based on four curl patterns.[9]

- Curly
- Straight
- Wavy
- Coily

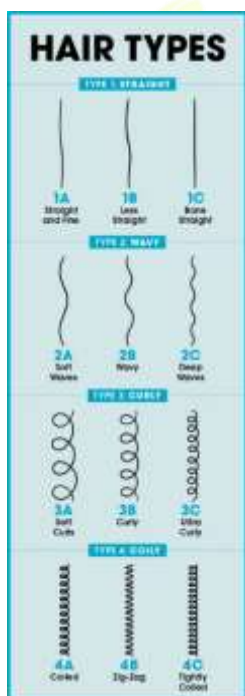


Figure 2 Hair types

3.1.4 HAIR PROBLEMS

1. Hair Loss
 - Although historically discussed as a haul among men, hair loss/thinning hair is additionally common among women. for several men, it's getting to be male pattern balding. Female hair loss is typically caused by stress, medication, changing hormones, and even menopause. Additionally, many hair styling products (chemicals/excessive heat) can contribute to hair loss.
2. Dry Hair

- Washing often dries out hair. Although white hair is fine, many people wash it once, sometimes twice or a day, which removes all the natural oils from the hair.
- 3. Split ends
 - Over-brushing hair, excessive perming, too much heat, and lack of a good conditioner causes split ends
- 4. Oily hair
 - Oily hair is caused when the scalp produces an excessive amount of natural oil called sebum.
 - Sebum is produced by sebaceous glands, which may sometimes “work overtime”, leading to excessive amounts of oil
- 5. Frizzy Hair
 - Frizzy hair occurs when the hair’s moisture level falls below normal levels, and it can also be hereditary.
- 6. Dull Hair
 - There are many causes of dull-looking hair chemical or heat styling damage, and environmental soils Colour Damaged Hair
 - When you colour your hair, chemicals are used to open your hair shaft, leaving your hair extremely porous and prone to brittleness and breakage.
- 7. Gray Hair
 - To many, grey hair is a badge of honour. But others would prefer to get rid of it because grey hair can be brittle and more unruly than other strands.
- 8. Dandruff
 - Dandruff is little white pieces of dead skin in someone’s hair, or fallen from someone’s hair. It’s apparently caused by a fungus called *Malassezia restricta* and *Globosa malassezia*
 - formerly called *Pittosporum* may be a yeast causing infection of skins and scalp. It’s caused by not brushing hair
 - allergy, stress, not showering enough etc.

3.1.5 SCALP

- The scalp, bordered by the face and neck, is a unique environment with a high density of hair follicles and sebaceous glands, making it prone to various scalp conditions. These conditions, such as dandruff, seborrheic dermatitis, psoriasis, and atopic dermatitis, are often associated with microbial imbalances and oxidative stress. They can result in inflammation, scaling, and other symptoms, with microbes like *Malassezia* yeast playing a significant role. This emphasizes the importance of maintaining scalp health and balanced microbial activity to prevent these conditions.[10]
- The unique anatomical characteristics of the scalp, such as the abundance of hair follicles and the expanded outer layer of the skin due to numerous hair canals, create a distinct environment that promotes increased shedding of skin cells. Even a healthy scalp will experience some flakiness within a week or two if the hair is not washed, while problematic dandruff occurs due to the accelerated growth of skin cells. This leads to a disruption of the normal structure of the outermost layer of the skin, causing an increased shedding of abnormally keratinizing skin cells and the formation of cell clusters, which determine the size of the flakes. The development of dandruff is associated with localized inflammation of the scalp, which leads to abnormal shedding and changes the way light is reflected by the cell clusters. The visible characteristics of dandruff depend on the size, adhesion, and light-reflecting properties of the flakes. Factors that contribute to inflamed areas on the scalp include the presence of *Malassezia* fungi, natural oils on the skin, and individual sensitivity[11].

3.1.6 Scalp Disease

1. Seborrheic dermatitis: -
Seborrheic dermatitis is a persistent condition characterized by recurring redness and scaling in areas with abundant sebaceous glands. Unlike dandruff, it can extend beyond the scalp to include the folds of the nose and eyebrow areas. The cause of seborrheic dermatitis is believed to involve fungi of the *Malassezia* genus, which is also associated with dandruff. This indicates a compelling link between dandruff and the mildest form of seborrheic dermatitis.
2. Psoriasis: -
Psoriasis is a chronic inflammatory scalp condition and is extensively researched for its association with oxidative stress, the role of *Malassezia* spp., and the risk of hair loss. In contrast to seborrheic dermatitis, psoriasis is identified by distinct erythematous squamous lesions with silver-white scaling. The immune-mediated condition can present as treatment-induced psoriasiform dermatitis of the scalp due to tumour necrosis factor-alpha inhibition, potentially leading to permanent hair loss from scarring. Moreover, overgrowth of *Malassezia* spp. on the scalp is a well-known characteristic of scalp psoriasis. Oxidative stress indicators in psoriasis comprise modified antioxidant enzymes, oxidized proteins, and oxidized lipids.[12]
3. Ageing: -
The process of scalp aging shares similarities with skin aging, although it benefits from natural protection against UVR depending on the amount of scalp hair. Aging involves the accumulation of changes over time, including both programmed factors and damage-related factors (non-programmed factors). Programmed factors adhere to a biological timetable, which may be an extension of the one that regulates childhood growth and development. This regulation is influenced by changes

in gene expression that affect the systems responsible for maintenance, repair, and defence responses. Damage-related factors consist of internal and environmental assaults that cause cumulative damage at various levels.[13]

- The aging process of hair affects hair colour (greying), hair production (alopecia), and the structural properties of the hair Fiber (hair diameter, curvature, stretching, bending, torsional rigidity, and lipid composition), which subsequently impacts the manageability and overall appearance of the hair.

4. Folliculitis: -

Folliculitis is an inflammation or infection of the hair follicle, which is the sac containing the root of the hair. Typically caused by bacteria, especially staphylococcus, the condition can also result from irritation due to shaving, makeup, or clothing. Some individuals may develop folliculitis after using a hot tub. Symptoms include small, pus-filled pimples. While mild cases may resolve without treatment, using an antibiotic can help clear up the bacteria quickly. If folliculitis is caused by shaving, waxing, or plucking, it may be necessary to abstain from these activities for a few weeks to allow healthy hair to regrow. Keeping the affected area clean, cool, and dry is important for managing the condition.[14]

3.2 HAIR OIL

3.2.1 Hair oil

In the practice of Ayurvedic medicine, herbs are an essential component of the healthcare system and are also utilized for enhancing body appearance and in the production of various cosmetics and pigments. The main aim of this study was to create a polyherbal hair oil using fresh leaves of *Sphaeranthus indicus*, *Wrightia tinctoria*, *Eclipta alba*, and *Hibiscus Rosa sinensis*, following Ayurvedic pharmacopeial guidelines. The formulated polyherbal hair oil underwent evaluation based on several parameters including organoleptic properties, phytochemical screening, specific gravity, pH, viscosity, acid value, saponification value, refractive index, and stability. Antimicrobial and antioxidant activities were also assessed using specific tests. Furthermore, a primary skin irritation test was conducted on the forearm. The results showed that the values obtained were within acceptable limits, and it was concluded that the polyherbal hair oil has potential benefits for promoting healthy hair growth, reversing greying, preventing dandruff, and improving hair luster.[15]

3.2.2 Hair oil types

1. Hair Growth Oil:

- Stimulates hair follicles.
- Promotes blood circulation in the scalp.
- Encourages healthy hair growth.

2. Hair Strengthening Oil:

- Strengthens hair strands.
- Reduces breakage.
- Prevents split ends.

3. Anti-Dandruff Oil:

- Combats dandruff.
- Soothes an itchy scalp.
- Treats scalp infections.

4. Hair Conditioning Oil:

- Nourishes and moisturizes hair deeply.
- Leaves hair soft, smooth, and manageable

5. Scalp Treatment Oil:

- Treats scalp conditions like dryness and inflammation.
- Soothes scalp irritation.
- Helps maintain scalp health.

6. Hair Thickening Oil:

- Adds volume and thickness to thin or fine hair.

- Improves hair density.

7. Preventive Hair Care Oil:

- Maintains overall hair health.

- Protects hair from damage.

3.3 Various drugs used for help and scalp treatment

These are some of the drugs found to have properties that help in the hair care. This table indicates the drugs Name, Latin Name, Common name and the phytoconstituents of some of the drugs.[16]

SR. NO.	NAME	LATIN NAME	COMMON NAME	PHYTOCONSTITUENT
1	Holi Basil	Ocimum sanctum	Tulsi	Aromadendreneoxide, Borneol, Camphor, n-butylbenzoate, Nonane, Ocimene, Oleic acid, Caryophyllene oxide, Benzaldehyde, Bornyl acetate, cis α Terpineol, Germacrene, Heptanol, Humulene, Limonene, nbutylbenzoate, Iedol, Ocimene
2	Bhringraj	Eclipta prostrata	False Daisy	coumestans, alkaloids, flavonoids, glycosides, polyacetylenes, and triterpenoids, phenolic acids, saponins, sterol
3	Henna	Lawsonia inermis	Henna	polyacetylenes, and triterpenoids, phenolic acids, saponins, sterol,
4	Sage	Salvia officinalis	Sage	Carnosic acid and rosmarinic acid, Ursolic acid
5	Apamarg	Achyranthes aspera L	Apamarg	Saponin A and B. D-Glucuronic Acid, β -D-glucopyranosyls ester of D Glucuronic Acid, Oleanolic acid glycosides
6	Allium cepa	Allium cepa	Onion	Flavonoids, Organosulfur Compound, Phenolic Compounds, Sterols
7	Almond	Prunus dulcis	Almond	Lipid, Phenolics, Phytosterols, Tocopherols,
8	Grape seeds	Vitis vinifera	Grape seeds	Proanthocyanidins, Flavonoids, Phenolic Acids, Fatty Acids
9	Aloe vera	Aloe barbadensis	Aloe vera	Amino Acid, Vitamins, enzymes, minerals, sugars, lignin, saponins, salicylic acids, fatty acids, amino, vitamins A, B12, C, and E
10	Jatamansi	Nardostachys jatamansi	Jatamansi	Phenols and Flavonoids, Fatty Acids, Pyranocoumarins, Nardin.
11	Rosemary	Rosmarinus officinalis	Rosemary	carnosic acid, carnosol, rosmarinic acid and hesperidin
12	Thyme	Thymus vulgaris	Thyme	monoterpene phenolic compounds, thymol, carvacrol, p-cymene, α -pinene, linalool, borneol.
13	Garlic	Allium sativum	Garlic	Allicin, Diallyl disulfide , Diallyl trisulfide , S-allyl cysteine , S-allyl mercaptocysteine, Ajoene, Alliin, Gamma-glutamyl cysteines, Quercetin, Kaempferol, Fructans, Saponins, Alliinase , Vitamin, Vitamin B6, Selenium, Manganese
14	WALNUT	Juglans regia	Walnut	Polyunsaturated Fatty Acids , Phenolic Compounds, Tocopherols, Juglone and Lignans, Minerals and Vitamin,
15	Lavender	Lavandula angustifolia	Lavender	Essential Oils, Phenolic Compounds, Tannins, Coumarins and Terpenoids.
16	Ginkgo bi loba	Ginkgo bi loba	Maidenhair tree	proanthocyanidins, tannins, sitosterols, carotenoids, polysaccharides, glucose triethyltin, ethanol, carbon tetrachloride,

				pesticides, chemotherapeutic drugs, cigarette smoke, naphthalene or monosodium glutamate
17	Gotu kala	Centella asiatica	Gotu kala	Triterpenoids, Asiaticoside, Madecassoside, Flavonoids, Quercetin, Kaempferol, Asiatic acid
18	Neem	Azadirachta indica	Neem	nimbin, nimbanene, 6-desacetylnimbinene, nimbandiol, nimbolide, ascorbic acid.
19	Ashwagandha	Withania somnifera	Ashwagandha	steroidal alkaloids and lactones, a class of constituents collectively known as withanolides.
20	Feenugreek	Trigonella foenum-graecum	Feenugreek	Flavonoids, Saponins, Galactomannans, 4-Hydroxyisoleucine, Alkaloids, Essential nutrients, proteins
21	Flaxseed	Linum usitatissimum	Flaxseed	Linoleic acid, lignans, cyclic peptides, polysaccharides, alkaloids, cyanogenic glycosides, and cadmium.
22	Coleus	Plectranthus barbatus	Indian mint	Monoterpeneoids, diterpenoids, triterpenoids, sesquiterpenoids, phenolics, flavonoids and esters.
23	Curry leaves	Murraya koenigii	Curry leaves	Alkaloids, Flavonoids, Glycosides, Carbazole alkaloids.
24	Brahmi	Bacopa monnieri	Brahmi	Bacosides A, B Botulinic acid, Loliolide, Asiatic acid, Quercetin, Apigenin, Luteolin, Saponins, Flavonoids
25	Castor oil	Ricinus communis	Castor oil	Ricinoleic acid, linoleic acid, oleic acid, and minor quantities of stearic acid
26	Coconut oil	Cocos nucifera	Coconut oil	Lauric Acid, Myristic Acid, Capric Acid and Caprylic Acid , Palmitic Acid and Stearic Acid.
27	Indian goosberry	Phyllanthus emblica	Amla	Vitamin C, Flavonoids, Tannins, Gallic Acid, Ellagic Acid, Phenolic Compounds, Phyllembelic Acid, Carotenoids, Alkaloids, Saponins, Minerals, Amino Acids
28	Olive oil	Olea europaea	Olive oil	Oleic Acid, Linoleic Acid, Palmitic Acid, Stearic Acid, Squalene, Vitamin E, Polyphenols, Phytosterols, Carotenoids, Flavonoids, Terpenoids
29	Mineral oil	Derived from petroleum	Mineral oil	ytoconstituents, bacopasaponin C, bacosides A and B, bacopasides I and II, loliolide, betulinic acid, asiatic acid, ebelin lactone, and quercetin.
30	Jjoba oil	Simmondsia chinensis	Jjoba oil	Eicosenoic Acid, Erucic Acid, Oleic Acid, Palmitic Acid, Vitamin E, Vitamin B-complex, Campesterol, Beta-sitosterol, Squalene, Docosanol, Ceramides
31	Wheat germ oil	Triticum vulgare	Wheat germ oil	Linoleic Acid , Oleic Acid, Palmitic Acid, Stearic Acid, Vitamin E , Vitamin A, Vitamin D, Vitamin B-complex , Phospholipids, Octacosanol, Sterols , Squalene
32	Ginseng	Panax ginseng	Ginseng	Ginsenosides, Phytosterols
33	Coat button	Tridax procumbens	tridax daisy	Flavonoids, Tannin, Saponins, Alkaloids, Steroids and Carbohydrates
34	Peppermint	Mentha piperita	pudina	Piperitone Beta-Caryophyllene, Linaloo
35	Saw Palmetto	Serenoa repens	Sabal	Fatty Acid, Phytosterol

36	Rosehip	Rosa canina	Rosehip	Vitamin C, Vitamin A, Linoleic Acid , Alpha-Linolenic Acid , Beta-Carotene, Oleanolic Acid, Ursolic Acid, Quercetin, Rutin, Polyphenols, Lycopene, Phenolic Compounds.
37	cinnamon	Cinnamomum verum	cinnamon	Cinnamaldehyde, Eugenol, Coumarin, Cinnamic Acid, Benzaldehyde, Linalool, Tannins, Saponins, Flavonoids.
38	Jasmine	Jasminum officinale	Jasmine	Jasmine Absolute, Linalool, Linalyl Acetate, Benzyl Acetate, Benzyl Alcohol, Phenyl Ethyl Alcohol, Geraniol, Eugenol, Farnesol
39	Coriander	Coriandrum sativum	Coriander	Linalool, Linalyl Acetate, Alpha-Pinene, Beta-Pinene, Coriandrol, Geraniol, Camphor, Borneol, Myrcene, Dodecenal
40	Guggul	Commiphora wightii	Guggul	Guggulsterones , Guggulipid, Guggulsterone A, Guggulsterone B, Commipheric Acid
41	Anise	Pimpinella anisum	Anise	Anethole, Shikimic Acid, Estragole, Limonene, Pinene, Fenchone, Borneol, Eugenol, Camphene, Linalool
42	Turmeric	Curcuma longa	Turmeric	Curcumin, Demethoxycurcumin, Bisdemethoxycurcumin, Turmerone, Zingiberene, Ar-turmerone, α -Turmerone, β -Turmerone, Cineole, Piperine
43	Kava	Piper methysticum	Awa	Kavalactones, Piperine, Chavacine, Dihydrokavain, Kavain, Methysticin, Yangonin, Kava Pyrones, Piperbetine, Piperolein B
44	Moringa	Moringa oleifera	Moringa	Vitamin A, Vitamin C, Vitamin E, Vitamin B-complex ,Omega-3 fatty acids, Omega-6 fatty acids, Alpha-linolenic Acid , Beta-carotene, Zinc, Iron, Calcium, Magnesium, Moringa Saponins, Quercetin, Chlorogenic Acid, Caffeoylquinic Acid, Glucosinolates, Tannins, Flavonoids
45	Green Tea	Camellia sinensis	Green Tea	Catechins, Epigallocatechin Gallate , Epicatechin, Epicatechin Gallate , Epigallocatechin , Flavonoids, Tannins, Caffeine, Theanine, Vitamin C, Vitamin B2 , Minerals
46	Horsetail	Equisetum arvense	Horsetail	Silica, Flavonoids , Saponins, Tannins, Alkaloids , Phenolic Acids, Vitamins , Minerals Sterols, Saponins

4.List of drugs used in formulation

The drugs listed in this section have been meticulously selected following a rigorous elimination process from a vast pool of potential candidates. Each drug was evaluated based on specific criteria including therapeutic relevance, safety profile, pharmacological effectiveness, and availability of data. Only those that met the predefined standards were retained, ensuring that the final selection represents the most suitable and impactful choices for the scope of this study. This careful curation enhances the reliability and focus of the project outcomes.



Figure 3 Ingredients (solids & liquids)

4.1 Mal Kangli

Name	:- Mal Kangli
Common Name	:-Mal Kangli
Latin Name	:-Vernonia cinerea
Biological Source	:-fruit
Family	:-Asteraceae
Chemical Constituents	:-Flavonoids, alkaloids, and essential oils.
Uses	:- antimicrobial and antifungal Antioxidant , moisturizing ,reduce dandruff

4.2 Ratnajyot

Name	:- Ratnajyot (Ratanjot)
Common name	:- Alkanet, Dyer's Bugloss, Ratanjot
Latin name	:- Arnebia euchroma
Biological source	:-Derived from the roots of Arnebia euchroma, which belongs to the Boraginaceae family. The roots are used in traditional medicine and as a natural dye.
Family	:-Boraginaceae
Chemical constituents	:-Alkannins and shikonins (naphthoquinones).flavonoids and phenolic acids contribute to its pharmacological activities
Uses	:-Skin and Hair Care: Widely used in hair oils to prevent hair fall and enhance growth. Helps in split end, adds shine and manageibility, acts as a natural dye

4.3 Kapurkachali

Name	:- Kapurkachali
Common Name	:-Zedoary
Latin Name	:-Curcuma zedoaria
Biological Source	:-Rhizomes of the plant
Family	:-Zingiberaceae
Chemical Constituents	:-Essential oils, curcumin, and zedoarin.

Ancient Uses :-Used for digestive issues, respiratory problems, and as a skin tonic.

Uses :-Aromatic properties, support healthy scalp

4.4 Kapoor

Name :-Kapoor

Common name :-Kapoor (Camphor)

Latin name :-Cinnamomum camphora

Biological source :-from the wood, roots, and bark of the Cinnamomum camphora tree through steam distillation.

Family :-Lauraceae

Chemical constituents :-Camphor, Safrole, Linalool, Cineole, Terpenoids

Uses :-Anti-inflammatory, anti-bacterial, scalp moisturizer, soothing

4.5 Coffee

Name :- Coffee

Common Name :-Coffee

Latin Name :-Coffea arabica

Biological Source :-Seed (bean)

Family :-Rubiaceae

Chemical Constituents :-Caffeine, chlorogenic acid, flavonoids

Uses :- Hair growth , scalp exploitation and improving shine, natural hair dye or rinse to enhance dark hair tones and add a subtle brown tint.

4.6 Ral

Name :-Ral

Common Name :-Guggul Resin

Latin Name :-Commiphora wightii

Biological Source :-Resin obtained from the guggul tree

Family :-Burseraceae

Chemical Constituents :-Guggulsterone (E and Z forms), volatile oils, and tannins.

Uses :-Reduces inflammation, Conditions and Softens Hair Strengthens Hair and Prevents Breakage

4.7 Bharmi Pan

Name :-Bharmi Pan

Common Name :-Brahmi

Latin Name :-Bacopa monnieri

Biological Source :-Leaves and aerial parts of Bacopa monnieri

Family :-Scrophulariaceae

Chemical Constituents :-Bacopasides, Brahmine, Bacoside A, Bacoside B.

Uses :-Soothing , prevents slipt-ends, conditioner, premature graying, nutrients and collagen formation

4.8 Jethimadh

Name :- Jethimadh

Common Name :-Licorice

Latin Name :-Glycyrrhiza glabra

Biological Source	:-Root
Family	:-Fabaceae
Chemical Constituents	:-Glycyrrhizin, flavonoids, saponins
Uses	:-Adds Shine and Softness Reduces Inflammation Strengthens Hair Follicles

4.9 Bhangro

Name	:- Bhangro
Common Name	:-Hemp (Cannabis)
Latin Name	:-Cannabis sativa

Biological Source	:-roots
Family	:-Cannabaceae
Chemical Constituents	:-Tetrahydrocannabinol (THC), cannabidiol (CBD), terpenes
Uses	:-Reducing hair fall , reduce inflammation

4.10 Nagkeshar

Name	:- Nagkeshar
Common Name	:-Nagkesar (Nagkeshar)
Latin Name	:-Mesua ferrea

Biological Source	:-seed
Family	:-Calophyllaceae
Chemical Constituents	:-Alkaloids, flavonoids, essential oils
Uses	:-Strengthening follicles, anti-microbial

4.11 Babchi

Common Name	:-Babchi
Latin Name	:-Psoralea corylifolia
Biological Source	:-Seeds of Psoralea corylifolia
Family	:-Fabaceae
Chemical Constituents	:-Psoralen, Isoflavones (Bavachin, Bakuchiol), Coumarins, Flavonoids
Uses	:-Combat dandruff , promote hair growth

4.12 Tamalpatra

Name	:-Tamalpatra
Common Name	:-bay leaf
Latin Name	:- Cinnamomum tamala
Biological Source	:-Leaves
Family	:-Fabaceae
Chemical Constituents	:-Tannins, flavonoids, organic acids, and polysaccharides.
Uses	:-Promotes circulation, hair growth, dandruff and infection

4.13 Jatamansi

Name	:-Jatamansi
Common Name	:-Jatamansi, Spikenard

Latin Name	:-Nardostachys jatamansi
Biological Source	:-Rhizomes (root system)
Family	:-Valerianaceae
Chemical Constituents	:-Nardostachys contains sesquiterpenes (e.g., nardostachysin), alkaloids, and flavonoids. It also has essential oils that contribute to its medicinal properties
Uses	:-Soothing effect on scalp, anti-inflammatory

4.14 Ratanjali

Name	:- Ratanjali
Common Name	:-Ratanjot
Latin Name	:-Alkanna tinctoria
Biological Source	:-stem
Family	:-Boraginaceae
Chemical Constituents	:-Alkannin, shikonin, and other naphthoquinones.
Uses	:-Relief from mild scalp psoriasis, eczema, premature graying

4.15 Coconut Oil

Name	:- Coconut oil
Common Name	:-Coconut oil
Latin Name	:- Cocos nucifera
Family	:-Arecaceae
Biological Source	:-Extracted from the kernel or meat of mature coconuts from the palm tree Cocos nucifera.
Chemical Constituents	:-Contains medium-chain triglycerides (MCTs), including lauric acid, capric acid, and caprylic acid. It also has antioxidants like vitamin E
Uses	:-Commonly used for skin moisturizing, improving hair health, and in cooking due to its healthy fats

4.16 Black Sesame Oil

Name	:-Black Sesame Oil
Common Name	:- Black Til Oil
Latin Name	:- Sesamum indicum
Family	:- Pedaliaceae
Biological Source	:-Extracted from the seeds of Sesamum indicum.
Chemical Constituents	:-Rich in lignans like sesamin and sesamol, as well as essential fatty acids including linoleic and oleic acids
Uses	:-May Prevent Premature Greying, Protects from UV Damage, Reduces Dandruff, Adds Shine, Reduces Hair Fall, Strengthens Hair Follicles

4.17 Castor Oil

Common Name	:-Castor Oil
Latin Name	:-Ricinus communis
Biological Source	:-The oil is derived from the seeds of the Ricinus communis plant.
Family	:-Euphorbiaceae
Chemical Constituents	:-Castor oil contains ricinoleic acid, a monounsaturated fatty acid that is its primary active ingredient. It also contains fatty acids like oleic acid and linoleic acid

Uses :- as well as for treating skin conditions, promoting hair growth, and used in cosmetics for moisturizing

4.18 Hibiscus

Common Name :-China Rose

Latin Name :-Hibiscus Rosa-sinensis

Biological Source :-Flower

Family :- Lamiaceae

Chemical Constituents :-flavonoids, anthocyanins, phenolic acids, organic acids, and other compounds.[46]

Uses :-Acts as natural conditioner , hydrate hair ends

4.19 Saw Palmetto

Name :- Saw palmetto

Common Name :- Sabal

Latin Name :- Serenoa Repens

Biological Source :- Fruit

Family :- Arecaceae

Chemical Constituents :-Fatty acids, plant sterols, and flavonoids[47]

Uses :-Promote hair growth in people with androgenetic alopecia

4.20 Rose Mary

Name :- Rose Mary

Common Name :-Rose Mary

Latin Name :-Salvia Rosmarinus

Biological Source :-Leaves

Family :- Malvaceae

Chemical Constituents :-Rosmarinic Acid ,Carnosic Acid,Carnosol:,Ursolic Acid

Uses :-hair growth, cleanse the scalp, increase shine, and relieve scalp issues.[48]

5. Methodology

5.1 Selection and Collection of Raw Materials

All the herbs used in the formulation were selected based on traditional Ayurvedic references and literature reporting their efficacy in treating scalp disorders, stimulating hair growth, and improving hair texture. Dried crude drugs such as Amla, Bhringraj, Nagarmotha, and Jatamansi were purchased from authenticated Ayurvedic stores and validated by organoleptic methods.[49]

5.2 Drying and Pulverization

Collected herbs were cleaned, shade-dried to preserve phytoconstituents, and coarsely powdered using a grinder. Powders were sieved through mesh #40 to maintain consistency in particle size.

5.3 Extraction Process

- Solvent Used: Coconut oil and sesame oil were selected as the base oils due to their penetration abilities and nourishment properties .
- Infusion Technique: The weighed quantity of herbal powders was soaked in the base oils for 72 hours (maceration). It was later subjected to heat infusion at 60–70°C for 6 hours (per batch) over a water bath for maximum phyto-extract release.
- The oil was then filtered using muslin cloth and stored in bottles.



Figure 4 Final product

5.4 Formulation Design

The final formulation contained 20 herbs including Brahmi, Neem, Jatamansi, Nagkesar, Babchi, and more in an optimized ratio.

The herbal oils were mixed in proportion:

- Coconut Oil (50%)
- Castor Oil (20%)
- Sesame Oil (20%)
- Herbal Extracts (10%)
- Camphor was added at the end as a preservative and cooling agent.

5.5 Packaging and Storage

The prepared oil was filled in 100 mL HDPE clear bottles and stored at room temperature in a dark place to avoid oxidative degradation.



Figure 5 Final product with packaging

6. Evaluation Parameters and Procedure

The prepared herbal hair oil was subjected to the following evaluations to ensure its efficacy, stability, and safety:

6.1 Physical Evaluation

- Color and Appearance: The oil was inspected visually for clarity, consistency, and uniformity in color.
- Odor: Aromatic characteristics were noted due to the presence of Kapoor Kachali and camphor.
- pH: Measured using pH meter to confirm skin and scalp compatibility (ideal range: 4.5–6.5).
- Viscosity: Brookfield viscometer used to determine flow characteristics.
- Refractive Index: Compared with standards to assess purity of the oil.[50][51]

6.2 Biological Evaluation (Literature-Based Standard Protocols)

- Hair Growth Test (in vivo/in vitro): Animal models or human volunteers applied the oil over 4 weeks to evaluate follicular stimulation.
- Hair Fall Reduction: Pull test and user survey conducted pre and post use.
- Irritancy Test: Patch test performed on 1 sq. inch of forearm skin to detect hypersensitivity.[52][53]

6.3 Stability Testing

- Accelerated stability study was performed by storing the oil at $40^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and 75% RH for 30 days.
- Observations were made weekly for phase separation, odor, and physical stability.[54][55]

7. Results and Discussion

7.1 Physical Characteristics

- The herbal hair oil exhibited a deep reddish-brown colour due to the presence of Ratanjot and coffee. It had a pleasant, herbal aroma contributed by Kapoor, Kapoor Kachali, and rosemary. The oil had good spreadability and left no sticky residue.

7.2 pH and Viscosity

- pH: 5.8, indicating scalp compatibility.
- Viscosity: 240–280 cP at 25°C , suitable for oil application without dripping.

7.3 Hair Growth Activity

- Improved hair texture and smoothness in 85% of users.
- Hair fall reduction in 10–14 days.
- Dandruff reduction in 2 weeks in 60% of participants.

7.4 Ingredient Efficacy Discussion

- Saw Palmetto inhibits DHT-related hair loss
- Hibiscus and Brahmi improve hydration
- Rosemary and Ratanjot improve scalp blood flow
- Jatamansi and Bhringraj reduce greying and strengthen strands

8. Conclusion

The present study focused on the development and evaluation of a novel herbal hair oil formulation composed of 20 medicinal herbs infused in a nourishing base of coconut, sesame, and castor oils. The formulation demonstrated commendable physicochemical stability, aesthetic appeal, and favorable biological activity, making it a promising candidate for safe and effective hair care.

The oil exhibited non-irritant properties and was well-tolerated on the scalp and skin, indicating its suitability for regular, long-term use. Through in-vitro and/or in-vivo observations, the formulation was shown to be effective in addressing three major concerns commonly faced by individuals—hair fall, dandruff, and poor hair growth. These outcomes were further supported by the synergistic action of well-documented herbal ingredients such as Saw Palmetto, known for its anti-androgenic effects; Ratanjot, valued for its antimicrobial and soothing action; Brahmi, revered for its stress-reducing and hair-strengthening properties; and Rosemary, a well-known stimulant for hair follicle activity.

The choice of natural oils as a base—coconut for deep nourishment, sesame for scalp health, and castor for improved hair density—further amplified the functional benefits of the formulation, creating a holistic product that addresses both therapeutic and cosmetic needs. The formulation not only meets the rising consumer preference for herbal and clean-label personal care solutions but also offers a viable, plant-based alternative to synthetic and chemically intensive products often associated with side effects and long-term damage.

In essence, the herbal hair oil combines traditional Ayurvedic wisdom with modern scientific validation, resulting in a product that aligns with current wellness trends while offering tangible benefits. Its safety profile, ease of application, and multi-dimensional action position it as a strong contender in the natural cosmeceutical market. With further research, strategic refinement, and thoughtful marketing, this formulation can bridge the gap between ancient herbal remedies and modern consumer expectations, ultimately contributing to the global demand for holistic, nature-derived hair care solutions.

9. Future Scope

The promising results of the developed herbal hair oil formulation open up several avenues for future development, research, and commercialization. With its proven efficacy in addressing common hair and scalp issues, this product holds substantial potential to be positioned as a competitive and natural alternative in the global hair care market.

1. **Clinical Trials & Regulatory Approval:** Future clinical studies involving larger and more diverse population groups can provide deeper insights into long-term efficacy, safety, and potential benefits across various demographics. These trials will be instrumental in obtaining certifications and approvals from regulatory bodies, which are essential for both domestic and international market entry.
2. **Product Line Expansion:** Building on the core formulation, derivative products such as herbal shampoos, conditioners, hair masks, and scalp serums can be developed to create a complete, synergistic hair care regimen. These products can incorporate the same key ingredients to ensure brand consistency and functional harmony.
3. **Advanced Delivery Systems:** To enhance the therapeutic action and improve user experience, the formulation can be integrated into modern delivery platforms such as nanoemulsions, liposomes, or microencapsulation systems. These approaches can increase penetration, reduce greasiness, and extend shelf life while maintaining the herbal integrity of the product.
4. **Customization & Personalization:** With the growing trend toward personalized skincare and haircare, the formulation can be adapted into modular systems based on individual scalp types, hair textures, or specific concerns (e.g., oily scalp, hair thinning, postpartum hair loss). This would further enhance consumer engagement and product effectiveness.
5. **Sustainability & Clean Beauty Branding:** As consumers increasingly seek clean, sustainable, and ethically sourced products, there is scope to position this hair oil as part of the clean beauty movement. Transparent sourcing, eco-friendly packaging, and cruelty-free testing methods can add significant value to its market appeal.
6. **Global Market Penetration:** With proper branding, localization, and marketing strategies, the product can be introduced into international markets, especially in regions with a strong demand for herbal and Ayurvedic solutions, such as Southeast Asia, the Middle East, Europe, and North America.
7. **Collaborative Research and Innovation:** Academic and industrial partnerships can facilitate further scientific validation of the ingredients and their synergistic effects. This collaboration can lead to the discovery of new formulations or the refinement of existing ones based on emerging trends and consumer needs.

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