

Formulation and Evaluation of Polyherbal Anti-Dandruff Hair Oil

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Abstract.

The current research focused on developing and evaluating a herbal hair oil designed to combat dandruff, utilising natural ingredients recognised for their therapeutic benefits in both hair and scalp care. Dandruff is a prevalent scalp condition primarily attributed to fungal infections, excessive dryness, inadequate scalp hygiene, and an overproduction of sebum. The ongoing use of synthetic anti-dandruff treatments can lead to irritation and other adverse effects. Consequently, herbal formulations are favoured due to their natural origins, safety, effectiveness, and higher acceptability among patients. In this study, Amaltas leaves powder was chosen as the principal active component due to its antifungal and antioxidant qualities. The formulation also incorporated other herbal ingredients such as Neem leaves, Amla, Hibiscus, Fenugreek Seeds, Coconut Oil, Rosemary Essential Oil, and Vitamin E.

The prepared formulation was evaluated for various physicochemical and biological parameters including colour, odour, appearance, pH, viscosity, stability study, irritation test, phytochemical screening, and antifungal activity. Phytochemical tests confirmed the presence of flavonoids, tannins, saponins, and terpenoids, which are responsible for antifungal and antioxidant activity. The irritation study showed that the formulation was safe and non-irritant for topical application.

The antifungal activity was evaluated by the agar well diffusion method against dandruff-causing fungi. The formulation showed a significant zone of inhibition, indicating good antifungal and anti-dandruff activity. Stability studies revealed that the formulation remained stable without phase separation or significant change in colour and odour.

Keywords: Herbal hair oil, Anti-dandruff activity, Amaltas, Antifungal activity, Herbal formulation.

Introduction.

One of the most significant aspects of a person's appearance is their hair. In addition to enhancing appearance, healthy hair reflects the scalp's overall health. People of all ages frequently experience hair issues like dandruff, hair loss, dryness, itching, scalp irritation, and premature greying in today's lifestyle. Among these ailments, dandruff is one of the most common scalp conditions affecting both men and women worldwide. In addition to itching and discomfort, dandruff is a chronic scalp ailment marked by excessive shedding of dead skin cells from the scalp. Fungal infections, excessive sebum production, dry scalps, poor hygiene, stress, pollution, and usage of chemical-based cosmetics are the main causes of dandruff. Mostly, the fungus

There are many synthetic anti-dandruff shampoos and creams on the market these days. Long-term use of these treatments may lead to side effects such as dryness, irritation, hair damage, and allergic reactions, even if they offer short-term relief. Because of these drawbacks, herbal formulations have become increasingly important because of their natural origin, safety, fewer side effects, ease of availability, and improved patient acceptance. One of the oldest and most successful traditional methods of hair care is the use of herbal hair oils. Herbal oils support healthy hair, strengthen hair roots, enhance blood flow, nourish the scalp, and prevent fungal growth. Numerous phytoconstituents found in medicinal plants, including flavonoids, tannins, saponins, alkaloids, and terpenoids, have antibacterial, antifungal, antioxidant properties.

DANDRUFF

White flakes, itching, and irritation are the hallmarks of dandruff. Fungal development, excessive oil secretion, inadequate scalp cleanliness, and environmental conditions are the main causes.

Dandruff

One of the most prevalent conditions affecting the scalp is dandruff, which is characterized by an excessive loss of dead skin cells. It frequently comes with dryness, pain, inflammation, and itching. Dandruff can have a detrimental impact on a person's appearance and self-confidence even though it is not a serious medical problem. The growth of *Malassezia* species on the scalp, which disturbs the normal scalp environment and speeds up skin cell turnover, is frequently linked to the disorder.

Reasons for Dandruff

Dandruff is caused by a number of reasons. Fungal infections, especially those caused by *Malassezia* species, are one of the main causes. Dry scalp, excessive sebum (oil) secretion, poor scalp cleanliness, pollution, stress, and regular use of harsh chemical-based hair care products are other contributing factors. Individually or in combination, these elements may disrupt the normal state of the scalp and encourage the development of dandruff.

Symptoms of Dandruff

White or yellowish flakes on the scalp and hair, ongoing itching, dryness of the scalp, irritation, and hair loss are typical signs of dandruff. Due to its obvious appearance, dandruff can occasionally cause pain and low self-esteem.

Oily Dandruff

Oily dandruff is associated with excessive production of sebum by the sebaceous glands and increased fungal growth on the scalp. The flakes are generally larger, yellowish, and tend to adhere to the scalp due to excess oil.

Dandruff Types

Dry dandruff and oily dandruff are the two basic categories of dandruff.

Dry Dandruff

Insufficient moisture in the scalp causes dry dandruff. It is typified by tiny, flaky, white flakes

that fall easily from the scalp and is frequently seen in cold, dry weather.

The following are the main causes of dry dandruff:

- A dry climate
- Overuse of shampoos
- Insufficient scalp lubrication
- Not enough moisture on the scalp

The following are the main causes of oily dandruff:

An excessive amount of scalp oil secretion • Inadequate scalp hygiene • A fungal infection • Excessive perspiration and pollution If neglected, oily dandruff can lead to scalp irritation, inflammation, and hair loss. It is frequently more persistent than dry dandruff.

Ingredients And Their Uses:

1. Amaltas -Antifungal
2. Neem – Antimicrobial
3. Amla –Strengthen Hair Roots
4. Hibiscus –Hair Conditioning
5. Fenugreek Seeds –Reduces Dryness
6. Coconut Oil –Moisturises Scalp
7. Rosemary Oil –Fragrance Enhancer
8. Vitamin E -Antioxidant

Literature Review:

An essential component of the human body, hair greatly influences both physical appearance and self-confidence. Hair health is negatively impacted by a number of scalp conditions, including dandruff, hair loss, itching, and fungal infections. Dandruff is one of the most prevalent ailments among these disorders that afflict people all over the world. It is frequently linked to fungal growth, especially *Malassezia* species, and is characterized by profuse shedding of dead skin cells from the scalp.

Because they are safer, more effective, and have less side effects than synthetic medications, herbal formulations have attracted a lot of interest lately. Antimicrobial, antifungal, anti-

inflammatory, and antioxidant qualities found in traditional medicinal plants are helpful for preserving scalp health and managing dandruff.

Materials and Methods:

Amaltas (*Cassia fistula*), Neem leaves (*Azadirachta indica*), Amla (*Emblica officinalis*), Hibiscus (*Hibiscus rosa-sinensis*), and Fenugreek seeds (*Trigonella foenum-graecum*) were the herbal components used to create the anti-dandruff hair oil. The base oil was coconut oil, and the active ingredients were vitamin E and rosemary oil. Every item utilized in the study came from local suppliers and was of the appropriate pharmaceutical grade.

Table 1: Representing the herbs with figures used in to the preparation of antidandruff hair oil.

	Amaltas (<i>Cassia fistula</i>): The antibacterial, antioxidant, and anti-inflammatory properties of amaltas are well-known. Amaltas's medicinal potential is attributed to a variety of phytoconstituents, including anthraquinones, flavonoids, and tannins. The plant may help treat scalp infections because it has been shown to have antibacterial activity against a number of harmful germs.
	Azadirachta indica, or neem: Neem's strong antibacterial and antifungal properties are well known. Bioactive components in the leaves, including quercetin, azadirachtin, and nimbidin, inhibit the growth of various bacteria. In traditional medicine, neem has been widely used to cure itching, scalp infections, and dandruff. According to studies, neem extracts enhance scalp hygiene and successfully inhibit the growth of fungi that cause dandruff.
	Emblica officinalis, or amla: Vitamin C, polyphenols, tannins, and flavonoids are all abundant in amla. It helps shield hair follicles from oxidative damage and demonstrates high antioxidant action. Amla has long been used to improve scalp health, prevent premature greying, strengthen hair roots, and lessen hair loss.

	Hibiscus rosa-sinensis, or hibiscus: Herbal hair care products have made extensive use of hibiscus. It has anthocyanins, flavonoids, mucilage, and other phytochemicals that support hair growth and nourish the scalp.
	Trigonella foenum-graecum, or fenugreek: Proteins, alkaloids, saponins, and mucilage are abundant in fenugreek seeds. To strengthen hair roots and lessen hair loss, they are frequently found in hair care products. dryness and inflammation on the scalp. Saponins provide a cleaning and conditioning function.
	Coconut oil: a base oil that hydrates the scalp and enhances the absorption of herbal ingredients.
	Oil of Rosemary: Formulations for hair care and cosmetics frequently use rosemary essential oil. It stimulates hair follicles, increases blood flow to the scalp, and encourages hair growth. Additionally, rosemary oil has antioxidant and antibacterial qualities
	Vitamin E: Hair follicles and scalp tissues are shielded from oxidative damage by vitamin E, a natural antioxidant. By reducing oxidation, it boosts the durability of oil-based treatments, strengthens hair, and improves scalp nourishment.

Using Herbal Hair Oil Is to Treat Dandruff

Herbal hair oils containing extracts from medicinal plants have been shown in numerous tests to have strong antifungal activity against bacteria that cause dandruff. Their therapeutic efficacy is attributed to the combined action of several phytoconstituents, including tannins, alkaloids, terpenoids, flavonoids, and saponins. In addition to managing dandruff, herbal hair oils enhance scalp health, lessen hair loss, and encourage healthy hair growth.

The chosen herbal components have encouraging pharmacological qualities that support their application in the creation of a potent herbal anti-dandruff hair oil, according to the literature

that is currently available. In order to control dandruff and maintain healthy hair, the current study was conducted to create and assess a herbal hair oil that contains amaltas, neem, amla, hibiscus, fenugreek, rosemary oil, and vitamin E.

Formulation of Herbal Anti-Dandruff Hair Oil

Four different formulations (F1, F2, F3, and F4) were prepared by varying the concentration of herbal ingredients. Coconut oil was used as the vehicle, and the final volume of each formulation was adjusted to 50 mL.

Table 2. Composition of Herbal Anti-Dandruff Hair Oil Formulations

Ingredients	F1 (50ml)	F2 (50ml)	F3 (50ml)	F4 (50ml)
Amaltas	6gm	8gm	10gm	10gm
Neem Leaves	4gm	3gm	3gm	4gm
Amla	4gm	4gm	4gm	5gm
Hibiscus	4gm	3gm	3gm	2gm
Methi Seeds	3gm	4gm	3gm	2gm
Coconut oil	25ml	25ml	25ml	25ml
Rosemary Oil	2ml	2ml	1ml	1ml
Vitamin e	2ml	1ml	1ml	1ml

Preparation of Herbal Anti-Dandruff Hair Oil

To get rid of dust and extraneous objects, the gathered herbal ingredients were thoroughly cleaned with water. Each material was roughly pulverized after being shade-dried. In accordance with the formulation design, weighed amounts of amaltas, neem leaves, amla, hibiscus, and fenugreek were added to coconut oil. To help extract the active phytoconstituents into the oil base, the mixture was heated gradually while being constantly stirred. Heating was maintained until full extraction was attained. After letting the produced oil cool, insoluble plant remnants were filtered out using muslin cloth. The filtered oil was combined with vitamin E and rosemary oil and properly blended. Coconut oil was used to get the final volume down to 50 ml. The created formulas were kept for later use in hygienic, airtight containers.

Result and Discussion:

Organoleptic Assessment and Test for Homogeneity An essential quality control metric for evaluating the physical appearance and acceptability of pharmaceutical and cosmetic formulations is organoleptic evaluation. The colour, odour, texture, and homogeneity of the prepared herbal anti-dandruff hair oil formulations were assessed.

Table 3. Organoleptic Evaluation and Homogeneity Test

Sr.no	Colour	Odour	Texture	Homogeneity
F1	Dark greenish brown	Mild herbal odour	Slightly oily	Homogeneous
F2	Brownish black	Pleasant herbal odour	Smooth, homogeneous, non-sticky	Homogeneous
F3	Brownish Green	Pleasant aromatic herbal odour	Slightly viscous and smooth	Uniform and homogeneous
F4	Dark greenish brown	Strong pleasant herbal odour	Smooth, homogeneous, good spreadability	Highly homogeneous

The results revealed that all formulations possessed acceptable organoleptic characteristics. Among the formulations, F4 exhibited the most desirable properties with a pleasant herbal odour, smooth texture, excellent spreadability, and high homogeneity. These characteristics indicate good formulation quality and user acceptability.

pH Determination

The pH of topical formulations plays a crucial role in maintaining scalp health and minimizing irritation. The pH values of all formulations were found within the acceptable range for scalp application.

Table 4. pH Determination:

Formulation	pH
F1	5.4
F2	5.2
F3	6.5
F4	6.1

The optimised formulation F4 had a pH of 6.1, close to the scalp's natural pH. This indicates good compatibility with scalp skin and reduced chances of irritation during long-term use.

Viscosity Measurement

Viscosity is an important parameter that influences the flow behaviour and ease of application of hair oil formulations. The viscosity of the optimised formulation (F4) was 98 cP. The obtained value indicates good flow characteristics and adequate consistency for topical application. The formulation could be easily spread on the scalp without excessive dripping and maintained satisfactory physical stability.

Spreadability Test

Spreadability determines the ease with which a formulation can be distributed over the application surface. The prepared herbal hair oil exhibited good spreadability, allowing uniform distribution over the scalp and hair. Good spreadability enhances user compliance and improves contact of the active ingredients with the scalp surface, thereby increasing therapeutic effectiveness.

Irritation Test

The irritation study was performed to assess the safety of the formulation for topical use. No signs of redness, itching, inflammation, burning sensation, or swelling were observed after application of the formulation. The results indicate that the herbal hair oil is non-irritant and safe for regular scalp application.

Stability Study

The stability study was conducted to evaluate the physical and chemical stability of the formulation during storage. No significant changes were observed in colour, odour, homogeneity, pH, or viscosity throughout the study period. The formulation remained

physically stable and retained its original characteristics, demonstrating satisfactory stability and shelf-life potential.

Principle of Antifungal Activity Research

The agar well diffusion method was used to assess the antifungal activity of the produced herbal anti-dandruff hair oil. This approach prevents fungal development around the well by allowing the formulation to spread through the agar medium that has been injected with fungal culture. The zone of inhibition is the clear area that developed around the well. A broader zone of inhibition indicates stronger antifungal action.

Test Organism

Malassezia species, one of the main microorganisms linked to dandruff and scalp conditions, was the fungal strain chosen for assessment.

Procedure

The medium known as Potato Dextrose Agar (PDA) was made and sanitized. Petri dishes were filled with the sterile medium, which was then left to harden. The fungal culture was uniformly spread over the agar surface using a sterile cotton swab. A sterile cork borer was used to create wells, and a micropipette was used to add the herbal hair oil compositions. The plates were incubated for 24 to 48 hours at the proper temperature. Following incubation, the zone of inhibition's width was assessed in

Antifungal Activity of Herbal Hair Oil

Batch Code	Zone of Inhibition
F4	19mm

According to the findings, the improved formulation F4 produced a 19 mm zone of inhibition and shown strong antifungal activity against *Malassezia* species. The detected inhibition zone shows how well the herbal composition inhibits fungal growth.

The higher concentration of herbal compounds included in formulation F4 may be responsible for its increased antifungal effectiveness. Biologically active substances with strong antifungal effects, such as azadirachtin, nimbidin, and quercetin, are found in neem (*Azadirachta indica*). Flavonoids, phenolic compounds, and other phytoconstituents that support antibacterial activity can also be found in Amaltas (*Cassia fistula*). Additionally,

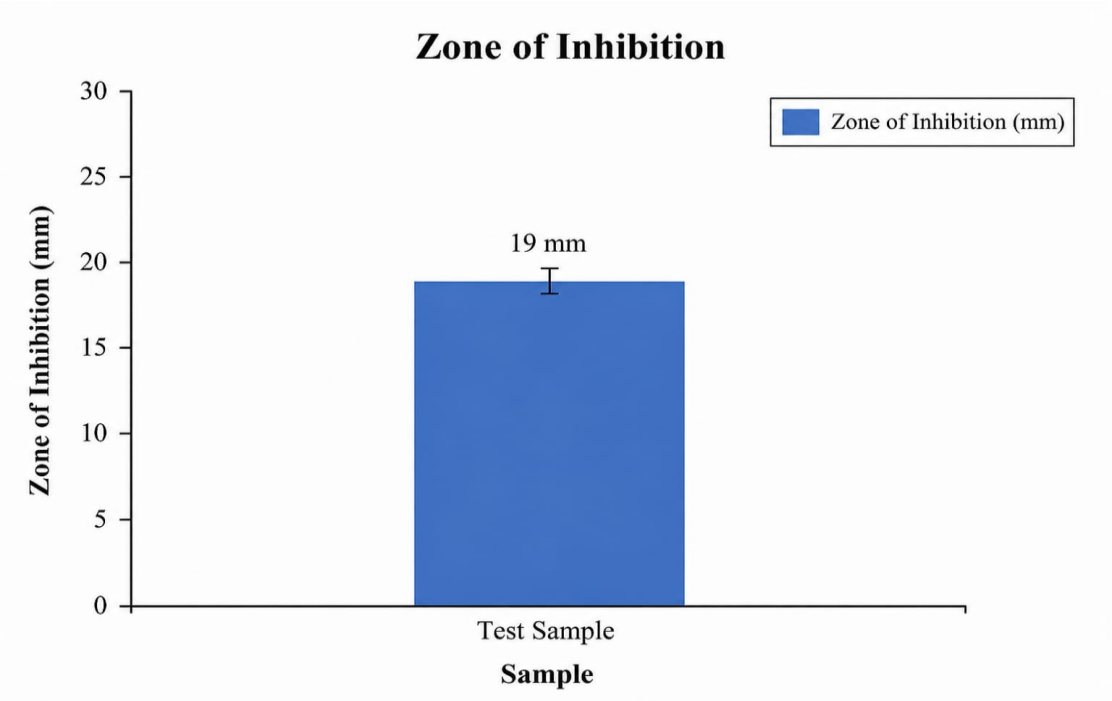
rosemary essential oil has broad-spectrum antibacterial properties and could improve the formulation's overall antifungal potency.

Tannins, saponins, terpenoids, and alkaloids were found in the herbal extract, according to preliminary phytochemical screening. According to reports, these phytoconstituents have antibacterial and antifungal properties, and they may work together to prevent the growth of fungi. The strong antifungal activity seen in formulation F4 may be the result of several bioactive chemicals working together.

The current study's antifungal activity validates the traditional usage of herbal substances for dandruff treatment and scalp care. The results indicate that the formulated herbal hair oil possesses promising antifungal potential against dandruff-causing fungi and may serve as a natural alternative to synthetic anti-dandruff preparations.

Antifungal Activity of Optimized Formulation F4 Against *Malassezia* Species

Fig no.1. Graph



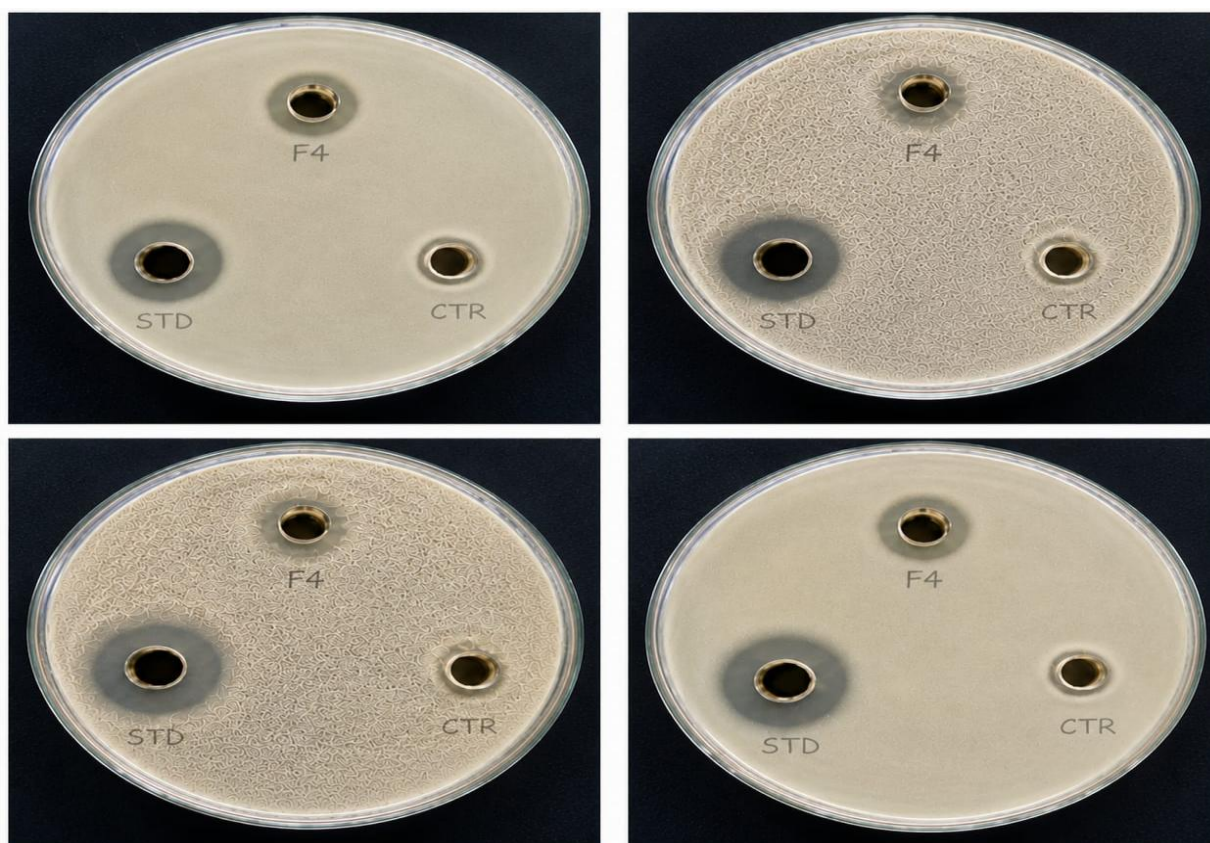


Fig no .2.Zone of inhibition

Results:

Significant antifungal action against *Malassezia* was demonstrated by the herbal anti-dandruff hair oil. The improved formulation F4 provided a zone of inhibition of 19 mm, demonstrating successful prevention of fungal growth.

Conclusion:

Using coconut oil as the base, the current study successfully developed and assessed a herbal anti-dandruff hair oil containing Amaltas (*Cassia fistula*), Neem (*Azadirachta indica*), Amla (*Embllica officinalis*), Hibiscus (*Hibiscus rosa-sinensis*), Fenugreek (*Trigonella foenum-graecum*), Rosemary oil, and Vitamin E.

Organoleptic properties, homogeneity, pH, viscosity, spreadability, irritation potential, stability, phytochemical screening, and antifungal activity were among the physicochemical and biological parameters that were assessed for four formulations (F1–F4). The outcomes showed that every formulation had acceptable quality qualities and could be used topically.

F4 has the best qualities out of all the created formulations. Excellent homogeneity, a nice herbal smell, decent spreadability, a pH of 6.1, a viscosity of 98 cP, and no indications of skin irritation were all displayed by the formulation. According to stability studies, there were no appreciable changes in the formulation's performance or appearance during the storage period, and it remained chemically and physically stable.

The created herbal anti-dandruff hair oil is safe, stable, and effective for scalp application, according to the study's findings. Its antifungal and scalp-protective qualities are attributed to the synergistic action of the chosen herbal constituents, which makes it a promising natural substitute for traditional anti-dandruff products. The herbal hair oil may help prevent dandruff, keep the scalp healthy, and encourage healthy hair development.

Future Scope:

To assess the formulation's long-term clinical efficacy in human subjects, more research may be done. To determine the economic potential of the created herbal anti-dandruff hair oil, further research involving microbiological analysis, expedited stability testing, and large-scale production can be carried out. Through in vivo research, the formulation's potential to strengthen and promote hair growth may also be investigated.

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