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Research Article

Formulation and Evaluation Study of Anti-Dandruff Herbal Shampoo

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ABSTRACT

Herbal formulation is a dosage form consisting of one or more than fresh herbs or processed herbs in particular quantities to provide specific nutritional cosmetics benefits and are meant to diagnose, treat, and alleviate disease of human beings. Herbal shampoo is at type of hair care product that uses natural herbs and botanicals as its primary ingredients. These shampoos are designed to promote healthy hair growth, inhibiting dandruff, improve scalp health and provide gentle cleansing without stripping the hair of its natural oils. The aim of the present work is to reveal the pharmacognostic , phytochemical and anti-dandruff activity for the formulation and evaluation study of Herbal shampoo. The required materials were collected from Trikaripur, Kasaragod and subjected to successive solvent extraction, later pharmacognostic studies like organoleptic evaluation, physical evaluation, chemical evaluation and biological evaluation were carried out. Shampoo is formulated and then the anti-dandruff activity is studied with extract of plant powder.

INTRODUCTION

Medicinal plants are one of the sources of natural products for the treatment and management of debilitating diseases. Plants which have one or more of its parts having substances that can be used for treatment of diseases, are called Medicinal plants. Medicines derived from plants are widely famous due to their safety easy availability and low cost.

HERBAL MEDICINE

Herbal medicine is defined as a branch of science in which plant-based formulations are used to alleviate diseases. It is also known as botanical medicine or phytomedicine. Later phytotherapy has been introduced as a more accurate synonym of herbal or botanical medicine. With the advent of the allopathic system of medicine, herbal medicine gradually lost its popularity among people. The

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WHO has recently defined Traditional medicine(including herbal drugs) has comprising therapeutic practices that have been in existence, often for 100 of years, before the development and spread of modern medicine and as still un used today. Traditional medicine is a synthesis of therapeutic experience of generations of practicing physicians of indigenous system of medicines. Traditional preparations comprise medicinal plants, minerals and organic matter etc. Herbal drugs constitute only those traditional medicines which primarily use medicinal plant preparation for therapy. Herbal medicines are complex compound with multiple synergistic mechanisms of action that modulate pathophysiological function. It has become a popular form of health care. Even though several differences exist between herbal and conventional pharmacological treatment, herbal medicine can be tested for efficacy using conventional trial methodology. Several specific herbal extracts have been demonstrated to efficacious for specific conditions.

ADVANTAGES

- Compared to synthetic medications herbal medicines typically have fewer side effects.
- Many herbal medicines are readily available and more affordable than synthetic medicines making them accessible to wider population.
- Herbal medicines can be used to treat wide range of ailments.
- Herbal medicines allow for personalized treatment plans tailored to individual needs such as lifestyle, constitution and underlying health conditions.
- Herbal medicines are obtained naturally and only involve lesser chemical process for their formulation hence it is considered as ecofriendly.

DISADVANTAGES

- Herbal remedies may lack standardize dosages and formulations leading to variability in potency and efficacy between products.
- Many herbs have been used for centuries, scientific research on their efficacy and safety is often limited compared to synthetic drugs.
- Herbal medicines often take longer to show results compared to conventional medications, requiring patients an consisting usage.
- Contamination with pesticides, heavy metals, or other pollutants can occur in herbal products, especially those sourced from unreliable and unregulated suppliers.

POLYHERBAL FORMULATIONS

Polyherbal formulation refers to a medicinal preparation that contains a combination of two or more herbs or herbal extracts. These formulations are created by blending multiple herbs with complementary or synergistic properties to enhance therapeutic efficacy or address multiple health concerns simultaneously. Polyherbal formulations plan has been utilized generally around the earth because of its restorative and remedial application.

Polyherbalism confers some benefits not available in single herbal formulations it is evident that better therapeutic effect can be reached with a single multi constituent formulation. For this, a lower dose of herbal preparation would be needed to achieve desirable pharmacological action , thus reducing the risk of deleterious side effects. Besides, PHF'S bring improved convenience for patients by eliminating the need of taking more than one different single herbal formulation at a time, which indirectly leads to better compliance and therapeutic effect. All these benefits have resulted in the popularity of PHF in the market when compared to single herbal formulation.

DANDRUFF

Dandruff is a common scalp condition characterized by flakes of dead skin, often accompanied by itching and redness. Here's a comprehensive overview:

Causes

1. Overproduction of skin cells: Skin cells are produced and die at a rapid rate, leading to flaking.
2. Fungal infections: Malassezia fungus, naturally found on the scalp, can contribute to dandruff.
3. Sensitivity to hair care products: Harsh chemicals in shampoos or conditioners can irritate the scalp.
4. Hormonal changes: Hormonal fluctuations, stress, and certain medical conditions can trigger dandruff.
5. Nutritional deficiencies: Lack of essential nutrients like zinc, vitamin B, or omega-3 fatty acids can contribute to dandruff.

Symptoms

1. White or yellowish flakes: Visible on the scalp, hair, or clothing.
2. Itching and redness: Scalp irritation, which can be mild or severe.
3. Scalp inflammation: Redness, swelling, and tenderness.
4. Hair loss: Excessive flaking can lead to hair loss.

Treatment

1. Medicated shampoos: Containing ingredients like zinc pyrithione, ketoconazole, or selenium sulfide.
2. Antifungal treatments: To control fungal infections.
3. Topical corticosteroids: To reduce inflammation and itching.
4. Home remedies: Coconut oil, olive oil, tea tree oil, and apple cider vinegar can help soothe and calm the scalp.

Prevention

1. Regular shampooing: Use a gentle, medicated shampoo.
2. Scalp massage: Stimulate blood flow and reduce stress. 3. Healthy diet: Include essential nutrients like zinc, vitamin B, and omega-3 fatty acids.
3. Reduce stress: Practice stress-reducing techniques like meditation or yoga.
4. Avoid harsh chemicals: Use gentle hair care products

TYPES OF DANDRUFF

1. Simple Dandruff

- Causes: Overproduction of skin cells, sensitivity to hair care products
- Symptoms: Mild flaking, itching, and redness
- Treatment: Medicated shampoos, gentle hair care products

2. Seborrheic Dandruff

- Causes: Overproduction of sebum, sensitivity to Malassezia fungus
- Symptoms: Yellowish, oily flakes, intense itching, and redness
- Treatment: Medicated shampoos, antifungal treatments, topical corticosteroids

3. Fungal Dandruff (Pityriasis Versicolor)

- Causes: Overgrowth of Malassezia fungus
- Symptoms: Discolored patches, flaking, and itching

- Treatment: Antifungal treatments, medicated shampoos

4. Contact Dermatitis Dandruff

- Causes: Allergic reactions to hair care products or environmental factors
- Symptoms: Redness, itching, and flaking
- Treatment: Avoid irritants, use gentle hair care products, topical corticosteroids

5. Psoriatic Dandruff

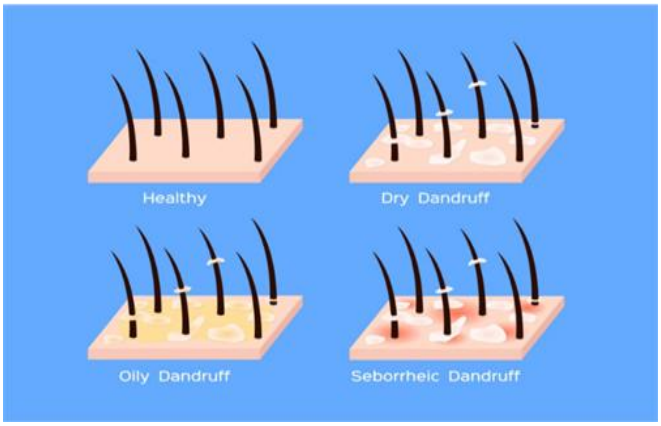
- Causes: Psoriasis, an autoimmune condition
- Symptoms: Red, scaly patches, flaking, and itching
- Treatment: Topical corticosteroids, vitamin D analogues, light therapy

6. Eczematous Dandruff

- Causes: Eczema, an allergic condition
- Symptoms: Red, itchy, and flaky patches
- Treatment: Topical corticosteroids, moisturizers, avoid irritants

7. Infectious Dandruff

- Causes: Bacterial or fungal infections
- Symptoms: Redness, itching, and flaking, accompanied by pus or discharge
- Treatment: Antibiotics or antifungal treatments, medicated shampoos



MATERIALS AND METHODS

Following herbs are used for the formulation of Herbal shampoo

GUAVA LEAF

Psidium Guajava Leaves

Medicinal uses

- Wound healing
- Antibacterial and antimicrobial properties
- Pain relief
- Skin and hair care
- Anti-inflammatory properties
- Anticancer properties
- Antidandruff

ARECANUT LEAVES

Areca Cathechu Leaves

Medicinal Uses

- Antimicrobial and Antibacterial activities

- Neuroprotective activity
- Antidandruff activity
- Skin and Wound healing

PREPARATION OF HERBAL SHAMPOO

1. **Plant collection**
   Fresh leaves of *Psidium guajava* and *Areca catechu* was collected from Kasaragod district, kerala, India in the month of November 2024. The plant materials are authenticated as *Psidium guajava*, *Areca catechu.*
2. **Washing**
   Collected herbal ingredients are washed with water.
3. **Drying**
   Herbal ingredients are dried under shade.
4. **Size reduction**
   The dried ingredients were size reduced using mixer grinder individually.
5. **Weighing**
   Powdered ingredients were weighed individually according to the formula. The required excipients were weighed.
6. **Extraction of Plant material**
   20g of powder(Guava leaves/Areca nut leaves) is mixed with 200ml water in a glass jar. Cover the jar with a lid and let it sit in cool & dark room. Shake the jar to facilitate extraction. After maceration , strain the mixture through cheese cloth or a clean cotton cloth into a collection container. Discard the solids. Filter the liquid extract through a filter paper to remove any impurities. Collect the aqueous extract.
7. **Preliminary phytochemical screening**
   The extracts of selected plants were subjected to phytochemical screening to detect various phytoconstituents present such alkaloids, glycosides, tannins, triterpenoids, flavonoids.
8. **Formulation of Herbal shampoo**
   In a small amount of the water (about 2.5 ml), slowly sprinkle the xanthan gum powder while stirring constantly. It will thicken quickly. In a clean, small container, combine the Areca Leaves Extract and Guava Leaves Extract. Gradually add the Shikakai powder to the extracts, stirring continuously to avoid lumps. Gently add the hydrated xanthum gum mixture to the extracts. Incorporate the Rose Oil and Coconut Oil. Slowly add the remaining water while stirring vigorously until you achieve the desired consistency.
9. **Filling**
   The final product is then filled in suitable container.

INVITRO ANTIFUNGAL ACTIVITY

MATERIALS

Malassezia pachydermatis MTCC 1369 strain, Potato dextrose agar, Formulation (F) and extract (Ex) at 500 µg/mL, Fluconazole (Flu) at a standardized concentration, Sterile Petri dishes, Sterilecork borer (6–8 mm diameter), Micropipettes, Sterile tips, and zone reader (mm).

METHODOLOGY

The antifungal activity of formulation (F) and extract (Ex) was evaluated using the well-diffusion method. PDA agar media was prepared and inoculated fresh 48 hours active *Malassezia pachydermatis* MTCC 1369 strain was spread on agar plates, and wells were created. Formulation (F) and extract (Ex) (500 µg/ml) concentrations and standard fluconazole (15 µg/ml) were added to the wells. During incubation, the inhibition zones around the wells were measured millimetres to assess the antibacterial efficacy against *Malassezia pachydermatis* MTCC 1369.

FORMULAE FOR THE DEVELOPMENT OF HERBAL SHAMPOO

Sr NO	INGREDIENTS	QUANTITY		
		FORMULA 1	FORMULA 2	FORMULA 3
1	Guava leaves aqueous extract	2.5ml	2.5ml	2.5ml
2	Arecanut leaves aqueous extract	2.5ml	2.5ml	2.5ml
3	Shikakai powder	1g	1.5g	2g
4	Xanthan gum	0.05g	0.08g	1g
5	Coconut oil	10ml	11ml	12ml
6	Rose oil	2 drops	3 drops	4 drops
7	Water	35ml	40ml	37ml

EVALUATION OF HERBAL SHAMPOO

1. **Physical appearance**
   Formulation prepared was evaluated for the clarity, color, odor, and foam producing ability.
2. **Determination of pH**
   A 10% v/v shampoo solution was constituted in distilled water and the pH of the solution was measured by using a calibrated pH meter.
3. **Rheological or Viscosity**
   The viscosity of the shampoos was determined by using Brookfield viscometer. 10ml of shampoo is taken in a beaker and spindle is dipped in it for about 5min, and then reading is taken.
5. **Foaming ability and Foam stability**
   Cylinder shake method was used for determining foaming ability. 50ml of the 1% herbal shampoo solution was put into a 250ml graduated cylinder & the cylinder was covered with hands and shaken for 10 minutes. The total volume of the foam content after 1 minute shaking was recorded. Immediately after shaking the volume of foam at 1-minute intervals for 10 minutes were recorded. The foam volume remains same throughout the period of about 5 min showing that the generated foam by the shampoo. has good stability and the prepared shampoo exhibits higher foam property.
6. **Determination of solid content percentage**
   The percentage of solid substance was determined by weighing about 4 g of shampoo in a dry, clean, and evaporating dish. The liquid portion of the shampoo was evaporated in a dish by placing on hot plate. The percentage and the weight of the solid contents present in the shampoo were calculated after drying completely.
7. **Dirt dispersion**
   Two drops of shampoo were added in a large test tube contain 10 ml of distilled water. 1 drop of India ink was added; the test tube was stoppered and shakes it ten times. The amount of ink in the foam was estimated as None, Light, Moderate, or Heavy.
8. **Cleaning action**
   5 grams of wool yarn were placed in grease, after that it was placed in 200 ml. of water containing 1 gram of shampoo in a flask. Temperature of water was maintained at 350C. The flask was shake for 4 minutes at the rate of 50 times a minute. The solution was removed and sample was taken out, dried and weighed. The amount of grease removed was calculated by using the following equation:

DP= 100(1-T/C) In which, DP is the percentage of detergency power, C is the weight of sebum in the control sample and T is the weight of sebum in the test sample.

9. Detergency ability

The Thompson method was used to evaluate the detergency ability of the samples. Briefly, a crumple of hair was washed with a 5%sodium lauryl sulfate (SLS) solution, then dried and divided into 3g weight groups. The samples were suspended in a hexane solution containing 10% artificial sebum and the mixture was shaken for 15minutes at room temperature. Then samples were removed, the solvent was evaporated at room temperature and their sebum content determined. In the next step. each sample was divided into two equal parts, one washed with 0.1 ml of the 10% test shampoo and the other considered as the negative control. After drying, the resided sebum on samples was extracted with 20 ml n-hexane and re-weighed. Finally, the percentage of detergency power was calculated using the following equation: DP-100(1-T/C) In which, DP is the percentage of detergency power, C is the weight of sebum in the control sample and T is the weight of sebum in the test sample 3, 4.

10. Skin Irritation Test

Prepared herbal shampoo was applied on skin for 5 minutes after that was washed and tested for irritation or inflammation to the skin.

11. Stability studies

The thermal stability of formulations was studied by placing in glass tubes and they were placed in a humidity chamber at 45°Cand 75% relative humidity. Their appearance and physical stability were inspected for a period of 3 months at intervalof one month.

RESULTS AND DISCUSSION

Phytochemicals present in the extracts of crude drug

SR NO	Chemical constituents	*Psidium guajava*	*Areca catechu*
1	Alkaloids	+++	++
2	Flavonoids	++++	+++
3	Phenolic compounds	+++	+++
4	Tannins	++	++
5	Triterpenes	+	+

EVALUATION OF HERBAL SHAMPOO

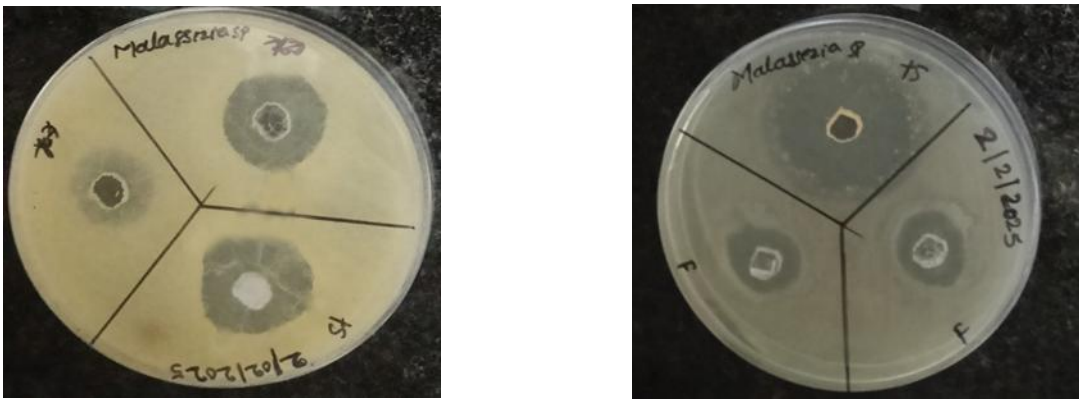
SI NO	Parameters	Formulation		
		F1	F2	F3
1	Color	Light brown	Light brown	Light brown
2	Odor	Pleasant and herbal	Pleasant and herbal	Pleasant and herbal
3	Clarity	Slightly hazy	Slightly hazy	Slightly hazy
4	Ph	6.8	6.6	6.6
5	Viscosity	1.951cps	1.924cps	1.911cps
6	Foam type	Dense	Dense	Dense
7	Foaming ability	20ml	18ml	18ml
8	Solid content	29%	30%	27%
9	Dirt dispersion test	Moderate	Moderate	Moderate
10	Skin irritation test	No irritation/ harmful effects	No irritation/ harmful effects	No irritation/ harmful effects

INVITRO ANTIFUNGAL ACTIVITY BY WELL-DIFFUSION METHOD

The antifungal activity of the formulation and extract was conducted against fungus *Malassezia pachydermatis* MTCC 1369 strain using the well-diffusion method. Their zone of inhibition was observed and measured in diameter (mm).

Antifungal activity of the formulation (F) and extract (Ex) with inhibition zone in diameters (mm).

SR NO	Microorganism	Zone of inhibition(mm)		
		F(500µg/mL)	EX(500µg/mL)	Flu(15µg/mL)
1	*Malassezia pachydermatis* MTCC 1369	29mm	26mm	22mm



Antifungal activity of given extract and formulation

The antifungal activity of the formulation and extract against Malassezia pachydermatis MTCC 1369 strain was evaluated using the well-diffusion method, with the zone of inhibition measured in millimeters. The results, presented in Table 1, demonstrate the effectiveness of both the formulation (F) and extract (Ex) at a concentration of 500 µg/mL compared to the standard antifungal drug fluconazole (Flu). The formulation exhibited the highest antifungal activity with a zone of inhibition of 29 mm, followed closely by the extract with 26 mm. Notably, both the formulation and extract outperformed fluconazole, which showed a zone of inhibition of 22 mm (Figure 1). These findings suggest that the formulation and extract possess potent antifungal properties against M. pachydermatis MTCC 1369, potentially offering promising alternatives or complementary treatments to conventional antifungal medications. The superior performance of the formulation compared to the extract indicates that the formulation process may have enhanced the antifungal efficacy of the active compounds. Further studies may be warranted to explore the mechanisms of action and potential clinical applications of these formulations in treating Malassezia-related infections.

DISCUSSION

The formulated herbal shampoo contains *Psidium guajava* and *Areca catechu* which are collected from Nileshwar, Kasaragod district were washed and dried under shade and powdered. The herbal

shampoo consisting of aqueous extracts of herbs in appropriate ratio was subjected to standardization. Herbal shampoos are widely used due to their no or less side effects compared to conventional shampoos, because it contains herbal ingredients of natural origin rather than chemical ingredients. These shampoos are designed to promote healthy hair growth, inhibiting dandruff, improve scalp health and provide gentle cleansing without stripping the hair of its natural oils. The Antifungal activity study was carried out and it showed that the aqueous extracts of *Psidium guajava* and *Areca catechu* has antifungal activity against *Malassezia pachydermatis* and the combination of these two extracts showed synergistic antifungal activity. It is determined using Well-diffusion method on cultures of *Malassezia pachydermatis* MTCC 1369 strain.

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