

Formulation and Evaluation of Polyherbal Anti-Dandruff Shampoo

Research Article

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Abstract

The *Malassezia furfur* fungal infection leads to dandruff formation. Dandruff cannot be fully eliminated but can only be effectively controlled. This study intends to formulate and evaluate the polyherbal anti-dandruff shampoo. The prepared formulation not only cleans the dirt and dandruff but also makes hair soft and lustrous and promotes hair growth. The formulation eliminates the use of harmful chemical ingredients that damages hair. The formulation uses various herbs like *Neem*, *Bhringraj*, *Shikakai*, *Tulsi*, *Reetha*, *Aloe vera*, *Lemon juice*, *Orange peel*, *Ginger*, *Curry leaves*, *Hibiscus* and other ingredients for preparing base shampoo which make an effective anti-dandruff formulation with smooth and shiny hairs, also provide conditioning and promotes hair growth. The formulated shampoo was subjected to evaluation parameters like visual inspection, pH, viscosity, dirt dispersion, surface tension, foaming ability, foam stability, antidandruff test and stability studies, etc. The major goal of the present study is to formulate and evaluate anti-dandruff shampoo for treating various hair issues. Dandruff is a common disorder affecting the scalp condition caused by yeast *Pityrosporum*. Dandruff cannot be completely eliminated but can only be managed and effectively controlled. Shampoo is a hair care product used for the removal of oils, dirt, skin particles, dandruff, environmental pollutants and other contaminant particles that gradually build up in hair. Herbal anti-dandruff shampoos were formulated using herbal based ingredients like Lemon Grass Oil, Neem oil, Henna, Aloe Vera gel and other ingredients for preparing base shampoo. The formulated shampoos were subjected to evaluation parameters like visual inspection, pH, viscosity, Percentage of solids contents, Dirt dispersion, Surface tension, Foaming ability and foam stability. The main objective of this study was to eliminate harmful synthetic ingredient from anti-dandruff shampoo formulation and substitute them with a safe natural ingredients.

Key Words: Anti-dandruff shampoo, Ayurvedic Shampoo, *Malassezia furfur*, Antimicrobial Activity, Polyherbal formulation, Keratolytic agent.

Introduction

Plants consist of many chemical constituents within which carry out various biological functions necessary for resistance or treatment of numerous diseases or disorders.

Dandruff is a skin condition caused due to fungus *Malassezia* fungi, which affects the scalp, makes it itchy and greasy (1). Dandruff is a common scalp disorder affecting almost half of the population. Keratinocytes play a key role in the expression and generation of immunological reactions during dandruff formation (2). The severity of dandruff worsens in winter. Various specialized shampoos were used to treat dandruff namely synthetic and herbal preparations.

The herbal shampoo is a type of cosmetic preparation that uses herbs that is natural ingredients from the plant (3). Any hair cleansing solution, made from the extracts of Ayurvedic herbs and flowers, can be termed as a 'herbal shampoo'. It can also be defined as a hair care product in form of viscous liquid used to remove dirt, oil from the hair and make them clean (4). The shampoo has abundant abilities like lubrication, conditioning, hair growth, reduction of hair loss, maintaining hair color, medication. It also has vital roles like anti-dandruff property, cleansing action, also acts as a keratolytic agent. The main aim of shampoo preparation is to clean dirt and dandruff, also used to make hairs soft and silky (5).

The purpose of the present investigation is to avoid the use of synthetic or chemical preparations that are available in the market. Several herbal ingredients with antidandruff properties were used, which makes hair soft and lustrous, promote hair growth (6). Importantly these preparations are cost effective, not much expensive (7). Various plants used for the formulation such as neem, tulsi, reetha, bhringraj, shikakai, hibiscus.

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Material and Methods

Herbs Sample Collection

The different parts of the plants selected for the study having hair care property which is already proved.

All the ingredients were purchased from local market of Yamuna-Nagar. The lists of herbs used are depicted in the Table 1.

Table 1. Herbs used in the formulation

Sr.No	Name of Drug	Botanical Name	Family	Plant Part	Qty. taken	Main Use
1	Neem	<i>Azadirachta indica</i> A. Juss	Meliaceae	Fresh Leaves	20 gm	Antifungal/ Antibacterial
2	Bhringraj	<i>Eclipta alba</i> (L.) Hassk.	Asteraceae	Powder of Leaves	5 gm	Antifungal/ Antibacterial agent
3	Shikakai	<i>Acacia concinna</i> Linn	Leguminosae	Leaves	20 gm	Nourish follicles
4	Fenugreek	<i>Trigonella foenum-graecum</i> L.	Fabaceae	Seeds	5 gm	Restore shine
5	Reetha	<i>Sapindus trifoliatus</i> linn	Sapindaceae	Seeds	20 gm	Antifungal/ Antibacterial agent
6	Aloe Vera	<i>Aloe barbadensis</i> miller	Liliaceae	Latex of Leaves	20 gm	Soothing agent
7	Lemon Juice	<i>Citrus limon</i> (L.) Burm	Rutaceae	Fresh Ripe Fruit Juice	2 ml	Preservative, antifungal
8	Tulsi	<i>Ocimum sanctum</i> L.	Lamiaceae	Fresh Leaves	20gm	Antifungal/ Antibacterial agent
9	Orange	<i>Citrus</i> Linn.	<i>Rutaceae</i>	Pericarp	20 gm	Antifungal/ Antibacterial agent
10	Ginger	<i>Zingiber officinale</i> Roscoe	Zingiberaceae	Rhizome	5 gm	Hair growth
11	Curry Leaves	<i>Murraya koenigii</i> Linn. <i>Sprengal</i>	Rutaceae	Fresh Leaves	5 gm	Antifungal/ Antibacterial agent
12	Hibiscus	<i>Hibiscus -sinensis</i> L.	Malvaceae	Fresh Leaves	5 gm	Antifungal/ Antibacterial agent

Preparation of Plant Extract

The composition was made by simple decoction process. All the herbs were accurately weighed by using digital balance the used quantity is listed in Table 1. The crude herbs were collected and these ingredients were size reduced using hand driven mixer individually grinded into powder, fine powder was passed through sieve no.120 and separately mixed with 100ml distilled water and kept for boiling till water gets reduced to one quarter. After boiling, the extract was cooled at normal room temperature and then filtered with muslin cloth to get the final filtrate

Sample collection, storage of *Malassezia furfur*

The fungus was collected with sterile cotton buds from the scalp by scraping the dandruff. The cotton was dipped in container consisting of sterile water and kept in refrigerator for further studies. Culture plates were made by swabbing the micro-organism on Petri plates containing agar and incubated for 2 days. The growth of micro-organism was observed. Identification studies were made for sample obtained.

In vitro identification of *Malassezia furfur* Morphological test

Fungus was smeared on clean glass slide and methylene blue was added over it, kept for 5 minutes and washed afterwards with distilled water and observed under microscope.

Biochemical test

Also known as catalase test in which 3% hydrogen peroxide was poured in test tube and fungus colonies was added to it, bubbling signifies release of oxygen from hydrogen peroxide.

Formulation of Herbal Shampoo

All the herbs (Table 1.) extract, 2 ml each was measured accurately and added in 100ml beaker and mixed with the help of magnetic stirrer. Guar gum weighed and was triturated separately with small quantity of water with help of mortar and pestle. In beaker containing uniform herbal extract solution, guar gum was added and stir to get uniform mixture subsequently other required ingredients were added and mixed. Sodium chloride was added to adjust the pH near to neutral which is compatible to skin. The final antidandruff mixture was stored in suitable plastic container and used for further evaluation parameters. Table 2

Table 2. Formulation of herbal antidandruff shampoo

Sr. No.	Ingredients	Qty (100ml)	Role
1	Herbal extract (Table 1)	24ml	Anti-dandruff/ Antifungal / Antibacterial agent
2	Sodium Laurel Sulphate	6gm	Surfactant

3	Guar gum	1gm	Stabilizer
4	NaCl (0.1M)	q.s.	pH Neutralizer
5	Glycerin	2ml	Humectant
6	Vitamin E	800mg	Antioxidant
7	Lavender oil	2 drops	Flavouring agent
8	Water	q.s.(to 100ml)	Diluent/vehicle

Evaluation Parameters for Antidandruff Shampoo Organoleptic properties

Developed formulation was evaluated for their color, physical state, odor, solubility was determined manually (8).

pH

10% v/v shampoo solution is prepared in distilled water and pH of this solution was measured with digital pH meter at room temperature 30±2°C (9).

Determination of percentage solids contents

A clean dry dish was weighed and added with 4 grams of shampoo. The dish with shampoo was weighed. The exact weight of the shampoo was calculated. The dish with shampoo was placed on the hot plate until the liquid portion was evaporated. The weight after drying was calculated (10).

Wetting time (sec)

A cotton ball weighing of about 0.44gm was taken and added it to container containing shampoo. Time taken for cotton to sink at bottom of the formulation was measured as wetting time (11).

Viscosity

The index of resistance to flow was determined using Brookfield viscometer DV-II + Pro at room temperature i.e. 30±2°C with varying rpm and torque (6).

Surface tension measurement

Dilute the shampoo using distilled water to fix 10% as concentration. Measurements were carried out using stalagnometer (12).

Foam formation/Foam stability

Cylinder shake method was used. 50ml of 1% solution of shampoo is taken in graduated cylinder (1ml in 100ml water), shake for ten minutes and record the foam produced after 1 minute. Record the stability of foam after 4-5 minutes (13,14).

In-vitro anti-dandruff activity

Well diffusion assay method was used. The antimicrobial efficiency of polyherbal anti dandruff shampoo was examined against *Malassezia furfur* using an agar well diffusion assay method. 500µl fungal cell suspension was spread onto the Sabouraud Dextrose Agar (SDA) plates and wells (8mm diameter was made on the agar plates using a sterilized stainless steel cork borer). The wells were loaded with 20µl of the respective shampoo. The plates were incubated at 35 °C

± 2 for 48 h and examined for the appearance of inhibition zones around the wells. The diameters of the inhibition zones were measured from the images using digital antibiotic zone reader (15,16,17).

Stability studies

Stability studies were performed in accordance with ICH guidelines for accelerated testing with required modifications. The sample taken formulation was taken and kept at room temperature (30 ± 2°C) as well as refrigerator (4±2°C) for duration of one month. The samples were tested for their physical appearance, pH, viscosity, % cleaning action and foam stability (18).

Results and Discussion

Results for various tests of physico-chemical parameters were shown in Table 3. Color of results was light brown, non-transparent, non-gritty, viscous in nature. pH observed for the formulation was about 5.60, which was non-irritant to skin too as per the skin irritancy test. Dirt dispersion ability is high for the formulation. Foam formation was 40ml and stable. Wetting time was found to be 11.2 seconds. Surface tension was 35.23 dyne/cm. whereas; viscosity was measured at various rpm. At 50, 60, 70, 80, 90, 100 rpm viscosity are 3800, 3170, 2710, 2380, 2110 and 1900 centipoises respectively. Formulation has good rinsing ability.

Table 3. Evaluation Parameters for Antidandruff Shampoo

Parameter	Observation
Color	Light brown
Odor	Lavender like
Clarity	Non-transparent
Appearance	Viscous
pH	6.70
% Solid content	33%
Wetting time	11.2 sec
Viscosity	3800 cps at 50 rpm
Surface tension	35.23 dyne/cm
Foam formation and foam stability	40 ml, stable foam

Figure 1. Evaluation of the antifungal activity against *M. furfur* well diffusion assay



In-vitro anti-dandruff activity

The agar-well diffusion method was used to assess the antifungal activity of the antidandruff formulation. The results shown in Figure 1 demonstrated that the polyherbal antidandruff formulation possesses inhibitory activity against *M. furfur*. This antimalassezial activity was observed with ZOI value 19.6mm. Therefore, the topical use of polyherbal antidandruff shampoo is useful in the treatment of dandruff.

Stability studies

Stability of formulation: It was checked for selected parameters (Table 4) after the interval of one month. There was marginal increase in pH reported for the developed formulation with increase in temperature, i.e. at 45±2°C after one month. When % cleansing action was assessed for developed formulation after one month, it was evident that % cleansing action was dropped at negligible level. Overall stability of shampoo developed from natural ingredients was good at a temperature ranging between 4 to 42°C (18).

Stability of prepared antidandruff shampoo formulation was checked for particular parameters after the interval of one month. Table 4. There was slight decrease in pH reported for the developed formulation with increase in temperature, i.e. at 45±2° after one month. When % cleansing action was assessed for developed formulation after one month, it was evident that % cleansing action was slightly increased. Overall stability of polyherbal antidandruff shampoo was good at a temperature ranging between 4 to 42°C (9, 10, 11).

Table 4: Stability studies

Evaluation parameters	Before 1 month	After 1 month
Color	Light brown	No Change
Odor	Pleasant	No Change
Transparency	Thick	No Change
pH	6.7 ± 0.5	6.6 ± 0.5
Solid content	33 ± 2%	33 ± 2%
Foam volume	40 ± 2ml	41 ± 2ml
Surface tension	35.23±0.5 dyne/cm	35.33±0.5 dyne/cm
Wetting time	11.2 sec	11.3 sec

Conclusion

The aim to develop the formulation which is stable and effective herbal shampoo and removal of synthetic ingredients was achieved in this study. The herbal anti-dandruff shampoo prevents dandruff and infection was verified by antimicrobial test. Although the synthetic ingredient sodium lauryl sulphate is present in preparation but is only about 6% which is less than synthetic shampoo and is in safe acceptable limit. pH of about 6.7 near to neutral shows that compatibility with skin. Evaluation study showed good wetting ability, good rinsing action, stable, foam foaming and good dirt dispersion activity. The present research successfully develops polyherbal antidandruff formulation.

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