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Formulation and evaluation of polyherbal antidandruff shampoo

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Abstract

The main aim of this research is to formulate and evaluate polyherbal anti-dandruff shampoo against the *Malassezia furfur*, by using ingredients from the natural sources. The herbs were extracted by using the simple decoction process. Most effective herbs-Shikakai, Reetha, Neem, *Aloe vera*, Hibiscus, Fenugreek, Onion juice, Sidar powder, Curry leaves were chosen in order to improve anti-dandruff activity. The formulations were evaluated for physical appearance, pH, dirt dispersion, determination of percent solid content, foam stability test, antimicrobial activity for *M furfur*, skin irritation test and stability testing. Stability studies were conducted for one month for all the three formulations and shows slight changes in their physicochemical properties. From the results, it may be concluded that First formulation meets all the requirements of the evaluation parameters which is harmless and cost effective.

Keywords: Polyherbal, anti-dandruff, formulation, evaluation, herbs

Introduction

Today a large population both man and women use shampoo for washing the hair. One of the main functions of shampoo is to remove dirt on the hair, sweat residue, flakes of horny layer sebum, and hair care cosmetics residues, dust and other external matter may present as dirt [1]. Various synthetic shampoos, available in the market known to cause harmful effects on the scalp and hair. Nowadays, people are aware of their effects on hair [2]. Therefore, about 80% of population in the world are getting attracted towards the herbal products due to their fewer side effects and less expensive. Nowadays, due to the good use of herbs in the cosmetics preparation has been extensively increased and therefore there is a great demand for the herbal cosmetics. This polyherbal shampoo was formulated using nature ingredients like Reetha, Aloe vera, Fenugreek, Neem, Hibiscus, Shikakai, Sidar Powder, Onion Juice, Curry Leaves [3]. Hair-care products are the products that help to repair and replenish the hair. These products may help to clean, modify the texture, change the colour of hair, provide nourishment, give healthy look, and give life to the stressed hair [4]. The hairs are of various types of like normal hair, dry hair, oily hair, which varies from one human to other human. In today's hectic life people don't have time to look after them and unable to do personal care. The various problems of hair may arise due to the use of chemical or synthetic shampoos like hair falling, greying of hair, dandruff, and Split end hair etc. The hair problems may arise due excess stress, scalp infection, low vitamin content, hormonal imbalance, minerals, food, and large and long-term use of chemical shampoo. To overcome all this problem was the main intension of our project. Cleanliness of scalp and hair is the most important consideration of personal life [5]. Dandruff is caused by yeast like fungus *Malassezia (Pityrosporum)* species that feeds on oils on the scalps of most adults. *Pityrosporum oval* is strongly suspected to play a role in the manifestation of the seborrheic dermatitis [6]. Due to the presence of fungistatic ingredients present in Antidandruff shampoos, dandruff can be easily treated. Due to the fewer side effects of herbal formulation, there is increase in demand in the world market. The synthetic shampoos leave the hair too dry to handle (or) comb. To avoid such problems, herbal shampoos will be beneficial for use. Dandruff may cause various symptoms seborrheic dermatitis, psoriasis fungal infection, or scalp & soreness, itching infestation of head lice [5].

Dandruff

Dandruff is skin condition caused due to fungus *Malassezia* fungi, which affect the scalp, makes it itchy and greasy Dandruff is a common scalp disorder affecting almost half of the population. Keratinocytes play a role in the expression and generation of immunological reaction during worseness in winter. Various specialized shampoo was used to treated dandruff namely synthetic and herbal preparations [7].

Introduction of dandruff

Dandruff represents one of the most common dermatological skin conditions and is a chronic, non-inflammatory condition of the scalp that is characterized by excessive scaling of scalp tissue. Dandruff is apparently caused by a fungus called *Malassezia restricta* and *M. globosa*. *Malassezia* is a yeast like fungus causing infection to the scalp and skin. It often because itching Dandruff is a non-inflammatory and chronic condition which is characterized in the most common dermatological skin problem, related to the scalp that is eminent by an excessive range of scalp tissue being affected. The main root of dandruff is not known properly, but there may be multiple factors such as, poor hygiene leading to fungal infection, oily scalp, and it appears more often if the hair is not washed for a week [8].

Classification of Dandruff

Depending upon the symptoms the dandruff is classified into two main types:

- A. Dry dandruff
- B. Oily dandruff

A) Dry dandruff

It is also called as pityriasis simplex characterize by excessive formation of minute scales which accumulate on the scalp area. This type of dandruff does not cause excessive hair loss. In this type, skin inflammation is not observed. The scales are first found in middle of the scalp and then spread frontal, parietal and occipital areas.

B) Oily dandruff

Clinically it is called as Pityriasis steatoides. It may cause due to the scalp with sebum production. It may occur during puberty. There may be inflammation on the scalp with dirty yellow colour oily scales. Due to these reasons, hair fall may occur in this condition. The most common site affected by this type of dandruff is scalp, behind the ears, over breast bone, armpits [9].

Shampoo

Hair is an important part of the overall appeal of the human body. The hairs of the head are associated with the beauty and social distinction. Whereas the hair has been trimmed, shaped and even colour since the most ancient times, relatively little emphasis has been placed on the process of cleaning it. Nowadays washing the scalp and hair with variety of shampoos have become a popular and nearly universal practice all over the world. Shampoos are the most widely used hair care products today, made by the synthetic ingredients as well as herbal ingredients [10].

A shampoo is a preparation of a surfactant (i.e. surface acting agent) available in a suitable form – solid, powder

or liquid. These surface-active agents are used under the specified conditions to remove dirt, surface grease, skin debris from the scalp and hair shaft without affecting the scalp, hair and skin.

Herbal Shampoo

“Herbal shampoos are the shampoos that contain ingredients from the natural origin, used for cleansing the hair. These shampoos are mainly used for the removal of dandruff, oils, dirt, environmental pollutants, etc. without any side effects [11].

Ideal properties of shampoos

Today’s shampoo formulations are beyond the stage of pure cleansing of the hair. Additional benefits are expected, e.g. conditioning, smoothing of hair surface, improvement of combability and leather creaminess.

1. It should remove soil or dust, excessive sebum or other fatty substances from the hair effectively and completely.
2. It should able to produce a good amount of foam to satisfy the psychological requirements of the user.
3. It should be easily and completely removed on rinsing with water.
4. It should leave the hair soft, lustrous, non-dry after washing.
5. It should give a pleasant fragrance to the hair.
6. It should not irritate the skin and eye.
7. It should be soft to the hands.
8. It should deliver an optimum level of foam to satisfy the psychological expectation of the user.
9. It should not damage to the tissues of the eye if inadvertently splashed [12].

Advantages of shampoo

- Cleansing properties
- Improving hair hygiene
- Treating scalp condition
- Treatment for dry scalp
- Treatment for hair loss
- Treatment for greasing or oily hair
- Relieves itch and irritation.
- Repairs damaged hair
- Shampoo keeps hair silky or smooth
- Keeps your hair beautiful and blossomed [13].

The main aim of the present study is to formulate and evaluate polyherbal antidandruff shampoo from herbal ingredient such as Neem, Hibiscus Leaves, Hibiscus Flower, Reetha Fruit, Henna, etc. which make hairs soft, lustrous, promote hair growth, prevent dandruff and minimizing the side effects of the synthetic formulation.

Table 1: Herbs used in the preparation of Polyherbal antidandruff shampoo and their use

Sr. No.	Herbs	Biological source	Use
1.	Shikakai	It consists of fruits of the plant <i>Acacia Concinna</i> , belonging to the family Leguminosae.	Promotes hair development, controls hair fall, battles dandruff, and adds bounce and shine to lifeless hair, used as conditioner for rich content of saponins, natural foaming agent, maintains healthy hair environment [12]
2.	Reetha (Soapnut, soap berry, washnut)	It consists of fruits of the plant <i>Sapindus Mukorossi</i> , belonging to the family Sapindaceae.	Shows cooling effect and excellent cleansing effect on the skin, prevent the scalp from drying [14]
3.	Neem	Neem consists of fresh or dried leaves and seed oil of <i>Azadirachta indica</i> , belonging to the family Meliaceae	Use in herbal shampoo. clean the scalp, clears the clogged pores and improves hair growth, extremely essential for the treatment of dandruff, endowed with antiseptic and healing properties, used for a variety of hair problems, helpful for removing dandruff using neem. According to Ayurveda, the herbs- Amla, Neem, Reetha, and shikakai are needed for enhancing hair growth [14]
4.	<i>Aloe vera</i>	Aloe is the juice collected by incision, from the bases of the leaves of various species of aloe, belonging to the family Asphodelaceae	Used in herbal shampoo, also reduce inflammation, which can help people with dandruff symptoms, such as itchiness. It is an antifungal and antibacterial properties of <i>Aloe vera</i> may prevent Dandruff, restore the PH of scalp and increases the growth of the hair. <i>Aloe vera</i> cleaned the hair shaft efficiently, stripping of extra sebum and residues from hair [15]
5.	Hibiscus	Hibiscus is the flowering plant of <i>Hibiscus sabdariffa</i> , belonging to the family Meliaceae.	most beneficial ingredient for hair, used for the growth of hair, its regrowth, and hair loss, carries amino acids, Vitamin A, C and alpha hydroxyl acids along with other nutrients that are highly beneficial for hair and scalp, keep scalp healthy and minimize the chances of dandruff from hair [14]
6.	Fenugreek	It consists of seeds and leaves of <i>Trigonella foenum-gracum</i> , belonging to the family Fabaceae.	rich in protein mucilaginous fiber, which encourage the moisturizer barrier in hair strand, also act as the simonising agent, and use to remove a dandruff [16]
7.	Onion juice	It is the juice obtained from the fresh bulb of <i>Onion cepa</i> , belonging to the family Liliaceae	contains a number of important minerals and vitamins, such as vitamins C and B6, calcium, magnesium, potassium, and germanium, also has high sulphur content. Sulphur is a mineral present in every cell in our body, with its greatest concentration in hair, skin and nails, often been called the "beauty mineral" and the "healing mineral" because of its ability to promote the hair growth and removing a dandruff from scalp [16]
8.	Sidar	It consists of leaves of the <i>Ziziphus jujuba</i> , belonging to the family Rhamnaceae	Traditionally used for washing and beautifying hair, rich in saponisides and mucilages, an ingredient of choice inn pulp vegetable shampoo, used to sooth the scalp and fight against dandruff and itchy skin [16]
9.	Curry leaves	These are the leaves obtained from the plant, <i>Murraya Koenigii</i> , belonging to the family Rutaceae	helps to control dandruff, has antifungal properties help in reducing dandruff and itchiness leaving with a clean scalp and healthy hair, moisturize scalp, promote hair growth, and prevents dandruff, leaves are rich in cell reinforcements that saturate the scalp while disposing the dead hair follicle, helps in preventing hair fall, premature hair greying [16]



Shikakai pods and powder



Reetha fruits and powder



Neem leaves



Aloe vera



Hibiscus flower



Fenugreek seeds and powder



Onion juice



Sidar powder



Curry leaves

Fig 1: Herbs used in the preparation of Polyherbal Antidandruff Shampoo

Materials and Methods

Collection of the herbs

The different parts of the plants were selected for the study having hair care property. The plants are methi powder, Hibiscus flower (*Hibiscus rosea*), Neem leaf (*Azadirachta indica*), Shikakai fruit (*Acacia concinna*), Aloe leaf (*Aloe barbadensis*), Sidar powder, Onion juice, Curry leaves. The raw materials collected were given with their respective biological source and uses as ingredients in the hair care; even they are responsible to provide the nutrition to the body. The selection of active ingredients for hair care powder is often based on the ability of the ingredient to prevent damage to the

hair as well as to improve the quality of the skin by way of cleansing, nourishing and protecting the hair ^[17].

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 No. 2. 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 number.120 and separately mixed with 100 ml 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 [7].

Sample collection, storage of *Malassezia furfur*

The fungus was collected with sterile cotton 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 [7].

Formulation of Polyherbal Antidandruff Shampoo

Polyherbal antidandruff shampoo was formulated by using simple mixing process. the extracts of all herbs were mixed with other ingredients as enlisted in the table 2. The final Polyherbal Antidandruff formulations were stored in suitable plastic containers and used for further evaluation parameters.

Table 2: Compositions of Polyherbal Antidandruff Shampoo

Sr. No.	Ingredients	Quantity		
		F1	F2	F3
1.	Shikakai	5 ml	5 ml	5 ml
2.	Reetha	6 ml	7 ml	8 ml
3.	Neem	5 ml	5 ml	5 ml
4.	<i>Aloe vera</i>	5 ml	5 ml	5 ml
5.	Hibiscus	5 ml	5 ml	5 ml
6.	Fenugreek	5 ml	5 ml	5 ml
7.	Onion juice	5 ml	5 ml	5 ml
9.	Curry leaves	5 ml	5 ml	5 ml
10.	Methyl paraben	2 mg	3mg	4 mg
11.	Gelatin	4 gm	4 gm	4 gm
12.	Citric acid	2 mg	3 mg	4 mg
13.	Gum tragacanth	0.5 gm	1 gm	2 gm
14.	Castor Oil	1 ml	1 ml	1 ml
15.	Coconut Oil	1 ml	1 ml	1 ml
16.	Rose Oil	1 ml	1 ml	1 ml

Evaluation parameters of polyherbal antidandruff shampoo

To evaluate the prepared formulations, quality control tests including visual assessment and physicochemical controls such as pH, density, viscosity, surface tension, foam volume, foam stability and wetting time were performed using standard protocols.

1. Physical appearance/visual inspection

The formulation prepared was evaluated for the clarity, colour, odour and foam producing ability and fluidity [18].

2. pH

The pH is calculated using pen pH meter. The pH was measured by using 1ml of shampoo into 5 ml distilled water then calculate the pH [19].

3. Dirt dispersion

In a large test tube, two drops of shampoo were containing 10 ml of distilled water. To this, 1 drop of Indian ink was added; the test tube was stoppered and shaken for 10 times. The amount of ink in the foam of was estimated as None, Light, Moderate, or heavy [20].

4. Determination of solid content percentage

A clean dry evaporating dish was weighed and 4 grams of shampoo was added to the evaporating dish. The evaporating

dish with shampoo was placed on the hot plate until the liquid portion was evaporated. The weight of the solid contents present in the shampoo was calculated after drying [21].

5. Foam stability test

The stability of foam was determined by using cylinder shakes method. About 25 ml of shampoo taken in 250 ml measuring cylinder and shaken for 10 minutes. The total foam volume was measured after 1 minute and foam stability was determined by recording foam volume from 1 to 4 minute [4].

6. Antimicrobial Activity

In this method the agar is melted, cooled at 45 C, inoculate with the test microorganism and then pour in the sterile petri plate. In this method when the agar plate has been solidified then holes about 9mm in diameter in the medium with sterile cork borer, Then the antimicrobial agent is placed in the hole and in another hole placed marketed formulation acts as standard, the diameter of zone of inhibition were measured after inoculation at 30-35°C for 2-3 days. The diameter of zone of inhibition gives an indication of the relative activity of different antimicrobial substance against tested microorganism [7].

7. Skin Irritation Test

Prepared polyherbal anti-dandruff shampoo was applied on skin for 5 minutes after washed and test for irritation or inflammation on the skin.

8. In-vitro anti-dandruff activity

Well diffusion assay method was used for checking anti-dandruff activity of three formulations of polyherbal anti-dandruff shampoo. The examination was done against *Malassezia furfur* using an agar well diffusion method. The microbial cell suspension was spread onto the Sabouraud Dextrose Agar (SDA) plates and wells were made by using sterilized stainless-steel corn borer. The wells were loaded with the polyherbal antidandruff shampoo. The plates were incubated at 35±2 °C for 48 hours. After the said time, plates were examined for the zone of inhibition around the wells. The diameter of the inhibition zones was measured manually by using the ruler [7].

9. Stability studies

The stability studies for the polyherbal anti-dandruff formulations were performed according to ICH guidelines. The formulations were tested for their physical appearance, % solid content, transparency, and pH [7].

Result and Discussion

Results for all the three polyherbal anti-dandruff formulations-F1, F2, F3 are shown in table 3. The color of all the three formulations is dark brown, non-transparent, non-gritty and viscous in nature. The PH of all the three formulations-F1, F2, F3 was 6.96, 6.43, 6.50 respectively, which was non-irritant to the skin according to the skin irritation test. The dirt dispersion test is also high for all the three formulations. The % solid content in all the three formulations is within the limit. The antimicrobial tests showed that the F1 formulation of polyherbal antidandruff shampoo shows large zone of inhibition as compared to later two formulations. The foam stability test for F1 formulation is good as compared to remaining two formulations.



Fig 2: Evaluation of the antifungal activity against M Furfur by Well diffusion assay method

Table 3: Evaluation parameters of Polyherbal Antidandruff Shampoo

Sr. No.	Evaluation parameter	Formulations		
		F1	F2	F3
1.	Appearance	Dark brown	Dark brown	Dark brown
2.	PH	6.96	6.43	6.50
3.	Wash ability	Washable	Washable	Washable
4.	Skin irritation	Non- irritant	Non- irritant	Non- irritant
5.	Anti-microbial test (Zone of Inhibition)	3.6 cm	3.2 cm	2.8 cm
6.	Dirt dispersions test	Light	Light	Light
7.	Foam -stability test	2 cm	1.5 cm	1.7 cm
8.	% Solid content	10.92%	12.9%	20.42%

Stability studies

Stability studies of formulation were carried out by checking the selected parameters, enlisted in table 4 after the interval of one month. Since, there is increase in temperature, there was marginal increase in PH reported for the developed formulation after one month. Stability studies of polyherbal antidandruff shampoo developed from herbal ingredients was good at temperature ranging between 4 to 42^o C. Stability studies for particular parameters of prepared polyherbal antidandruff shampoo formulation was checked after the interval of one month. It was observed that there was little decrease in the PH reported for the developed formulation with increase in temperature i.e. at 45±2^o after one month. Overall stability of polyherbal antidandruff shampoo was good at a temperature ranging between 4 to 42^oC [22].

Sr. No.	Evaluation parameters	Before one month			After one month		
		F1	F2	F3	F1	F2	F3
1.	Colour	Dark Brown			No change		
2.	Odour	Pleasant			No change		
3.	% Solid content	10.92%	12.9%	20.42%	No change		
4.	Transparency	Thick			No change		
5.	pH	6.96	6.43	6.50	6.7	6.2	6.3

Conclusion

The main aim of the formulated polyherbal anti-dandruff shampoo was to prevent dandruff and their infections. It was concluded that the formulated polyherbal anti-dandruff shampoos which were prepared by using the herbs, shows fewer side effects compared to the shampoo that are prepared by using various synthetic and harmful compounds. The formulated polyherbal antidandruff shampoo prevents

dandruff that was verified by the antimicrobial test. PH of the formulated polyherbal antidandruff shampoos is near to the neutral, shows that the formulations are non-irritant to the skin. Evaluation studies showed good appearance, good wash ability, non-irritant to the skin, good foam stability, good dirt dispersion activity. From the results, it may be concluded that F1 formulation meets all the requirements of the evaluation parameters among the two other formulations. Formulation F1 contains all the good characters of an ideal shampoo and found to be harmless, cost effective. The present research successfully developed polyherbal anti-dandruff formulations.

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Conflict of interest

The authors declare that there is no conflict of interest.

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