RESEARCH PAPER

Formulation And Evaluation Of Herbal Nagarmotha (Cyperus Rotundus) Shampoo

Manthan R. Jangam[1*], Snehal S. Patil[1], Vaishnavi Patil[1], Mulla Saniya Ismail[1], Ritu D. Rawate[1], Tanuja R. Mane[1], Pranali P. Pawar[1], Pratiksha S. Jagdale[1], Sanjana S. Sankpal[1], Sakshi R. Salunkhe[1], Vaishnavi B. Dharme[1], Rutuja S. Gadade[1]

[1] Department Of Pharmaceutics, Krishna Institute Of Pharmacy, Krishna Vishwa Vidyapeeth, Karad, Maharashtra, India.

Corresponding Author: Manthan R. Jangam, Email: jmanthan394@gmail.com, Contact No.: +91 7709715537

Orcid Ids: 0009-0002-7858-9102 (Manthan R. Jangam), 0009-0006-3823-7005 (Snehal S. Patil), 0009-0006-8749-3427 (Vaishnavi Patil), 0009-0007-3869-5687 (Mulla Saniya Ismail), 0009-0000-5358-8969 (Ritu D. Rawate), 0009-0002-4677-7002 (Tanuja R. Mane), 0009-0008-0895-4710 (Pranali P. Pawar), 0009-0007-4219-5300 (Pratiksha S. Jagdale), 0009-0005-8121-5031 (Sanjana S. Sankpal), 0009-0000-3190-3040 (Sakshi R. Salunkhe), 0009-0004-6580-7574 (Vaishnavi B. Dharme), 0009-0000-5336-5140 (Rutuja S. Gadade)

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Abstract

Herbal shampoos are increasingly preferred over synthetic formulations because of their safety, biodegradability, and minimal side effects. Conventional shampoos often contain synthetic surfactants and preservatives, which may cause scalp irritation, dryness, and hair damage upon prolonged use. This study aimed to formulate and evaluate a polyherbal shampoo containing cyperus rotundus (nagarmotha), reetha, ashwagandha, brahmi, methi, aloe vera juice, honey, and essential oils for the management of common hair and scalp disorders such as dandruff, hair fall, and microbial infections. The cyperus rotundus herbal extract was prepared using the maceration method. The physicochemical parameters of the formulated shampoo, including ph, washability, solubility, foaming stability, skin irritation, and stability, were evaluated. Antimicrobial activity was assessed against staphylococcus aureus, escherichia coli, and malassezia furfur using the agar-well diffusion method. The optimized formulation exhibited an ideal ph of 6, good washability, excellent foaming stability, and no skin irritation. Antimicrobial studies revealed significant antibacterial activity against s. aureus and e. coli, with inhibition zones comparable to that of standard streptomycin at higher concentrations, whereas moderate antifungal activity was observed against m. furfur. The results indicate that the developed herbal shampoo is safe, effective, and suitable for regular use by humans.

Keywords: Herbal Shampoo, Cyperus Rotundus, Nagarmotha, Antimicrobial Activity, Hair Care.

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INTRODUCTION :

Hair care and scalp hygiene play an essential role in personal grooming and overall health. Shampoos are widely used cosmetic preparations intended for cleansing hair and scalp by removing dirt, excess sebum, microbial load, and environmental pollutants[1,2]. Conventional shampoos commonly contain synthetic surfactants, preservatives, colorants, and fragrances that provide rapid cleansing action; however, prolonged use of such formulations has been associated with adverse effects including scalp irritation, dryness, hair fall, and damage to the hair shaft[3]. These limitations have created a growing demand for safer and milder alternatives derived from natural sources.

Herbal shampoos formulated using medicinal plants have gained significant popularity due to their biodegradability, biocompatibility, and reduced risk of side effects. Medicinal plants have been traditionally utilized for hair cleansing, conditioning, and treatment of various scalp disorders[4]. The bioactive phytoconstituents present in herbal ingredients exhibit antimicrobial, antioxidant, and anti-inflammatory properties, which are beneficial for maintaining scalp health and promoting hair growth[5]. Moreover, herbal formulations are suitable for long-term use and align with the increasing consumer preference for natural cosmetic products[2].

Among various scalp disorders, dandruff and microbial infections are common problems affecting a large population worldwide. Dandruff is primarily associated with excessive proliferation of microorganisms, particularly *Malassezia* species, leading to itching, flaking, and inflammation of the scalp[4,10]. Therefore, the incorporation of antimicrobial agents in shampoo formulations is essential for effective management of dandruff and scalp infections. Herbal ingredients possessing antimicrobial properties can offer a dual benefit of cleansing and therapeutic action without causing irritation[8].

Nagarmotha (*Cyperus rotundus*) is a well-known medicinal plant widely used in traditional systems of medicine. It has been reported to possess antimicrobial, antioxidant, anti-inflammatory, and antidandruff properties, making it a promising ingredient for hair care formulations[6]. In addition, Reetha (*Sapindus mukorossi*) is rich in saponins and acts as a natural surfactant, providing effective cleansing and foaming action. Other herbal ingredients such as Ashwagandha, Brahmi, and Methi are known to strengthen hair follicles, promote hair growth, and reduce hair fall[7,8]. Aloe vera juice and honey function as natural conditioners and humectants, improving hair moisture, smoothness, and shine[9].

Single-herb formulations may offer limited benefits; however, polyherbal formulations provide synergistic effects due to the presence of multiple bioactive constituents acting through different mechanisms[11]. Polyherbal shampoos are therefore considered more effective in improving overall hair and scalp health by combining cleansing, conditioning, and antimicrobial properties[12]. The synergistic interaction among herbal ingredients enhances therapeutic efficacy while minimizing adverse effects.

Based on these considerations, the present study was undertaken to formulate and evaluate a polyherbal shampoo containing *Cyperus rotundus* (Nagarmotha) along with selected herbal ingredients. The formulated shampoo was evaluated for physicochemical parameters, stability, and antimicrobial activity to assess its suitability as a safe and effective herbal hair care product.

MATERIALS AND METHODS :

Materials

The herbal ingredients used in the formulation of the shampoo included *Cyperus rotundus* (Nagarmotha), *Sapindus mukorossi* (Reetha), *Withania somnifera* (Ashwagandha), *Bacopa monnieri* (Brahmi), and *Trigonella foenum-graecum* (Methi) in powdered form. Aloe vera juice, honey, chamomile oil, and rose oil were procured from local authenticated herbal markets. Sodium lauryl sulfate (SLS) and citric acid were obtained from pharmaceutical laboratories. All chemicals and reagents used in the study were of analytical grade and were used without further purification.

Method of Extraction (Maceration Method)

Nagarmotha powder (50 g) was accurately weighed and transferred into a clean, dry, stoppered conical flask. A hydroalcoholic solvent system consisting of ethanol and distilled water in the ratio of 50:50 was added in sufficient quantity to completely immerse the powdered drug. The flask was sealed and kept at room temperature for 14 days with intermittent shaking to facilitate efficient extraction of phytoconstituents.

After completion of the maceration period, the mixture was filtered using muslin cloth followed by Whatman filter paper. The clear filtrate was collected and stored in a well-closed container for further formulation. Maceration was selected as the extraction method due to its simplicity, cost-effectiveness, and suitability for thermolabile herbal constituents[9].

Figure 1: Extraction of Nagarmotha by maceration method

Formulation of Herbal Shampoo

The compositions of the herbal shampoo formulations are listed in Table 1.

Table 1: Composition of herbal shampoo formulations

Sr.no	Name of ingredients	Application of components	Segment A	Segment B	Segment C	Segment D
1	Nagarmotha	Scalp disorder,to prevent dandruff.	5ml	7ml	5ml	12ml

2	Reetha powder	Foaming agent,cleaning agent.	4gm	5gm	5gm	10gm
3	Ashwagandha powder	Hair growth promoter,control hair fall.	2gm	1gm	2gm	4gm
4	Brahmi powder	Support hair growth	2gm	1gm	2gm	4gm
5	Methi powder	Conditioning and nourishing of hair	2gm	1gm	2gm	4gm
6	Aloevera juice	Smoothing and conditoning.	3ml	2gm	3ml	5ml
7	Honey	Shining and moisturizing hair.	2ml	3ml	1ml	3ml
8	Chamomile oil	Smooth scalp and to reduce irritation.	2ml	1ml	1ml	2ml
9	Citric acid	To mainatin p.H	1.5 ml	1ml	1ml	2ml
10	Rose oil	Fragrance	0.5 ml	1ml	1.5 ml	1ml
11	Sodium lauryl sulphate	Surfactant	1ml	2ml	1.5 ml	3ml

Procedure for Shampoo Preparation

Aqueous extracts of Ashwagandha, Brahmi, and Methi were prepared separately by boiling the respective powders in distilled water, followed by filtration to obtain clear extracts. Reetha extract was prepared using the same method and used as a natural foaming agent. The Nagarmotha macerated extract was mixed with the prepared aqueous extracts under continuous stirring to ensure uniformity. Aloe vera juice and honey were added gradually with constant stirring. Sodium lauryl sulfate was then incorporated slowly as a surfactant to enhance cleansing and foaming properties. Citric acid was added in small quantities to adjust the pH of the formulation to a skin-friendly range. Finally, chamomile oil and rose oil were added as soothing and fragrance agents, respectively.

The prepared formulation was allowed to stand for 48 h at room temperature to achieve uniform consistency and complete stabilization of the ingredients.

Evaluation of Herbal Shampoo

pH Determination

The pH of the prepared herbal shampoo was determined using a calibrated digital pH meter. The pH electrode was immersed in the shampoo solution, and readings were recorded after stabilization. The pH of the formulation was found to be 6, which falls within the acceptable range (5–7) for hair and scalp applications[10].

Figure 2: pH determination of herbal shampoo

Washability

Washability was evaluated by applying a small quantity of shampoo onto the skin followed by rinsing with water. The ease of removal and absence of residue were observed. The formulation exhibited good washability characteristics.

Figure 3: Washability test of herbal shampoo

Solubility

Solubility was assessed by dissolving a measured quantity of shampoo in distilled water. The formulation showed good solubility, forming a clear and uniform solution.

Figure 4: Solubility test of herbal shampoo

Skin Irritation Test

The prepared herbal shampoo was applied on a small area of skin and observed for signs of redness, itching, or irritation. No adverse reactions were observed, indicating that the formulation was safe for topical application.

Foaming Stability

Foaming stability was evaluated by shaking a measured quantity of the shampoo with distilled water in a graduated cylinder. The height and stability of the foam were observed over time. The formulation showed adequate and stable foam, which is essential for consumer acceptability[11].

Figure 5: Foaming stability of herbal shampoo

Stability Study

The herbal shampoo formulation was stored in a well-closed container at room temperature and observed periodically for changes in color, odor, and consistency. No significant changes were observed during the study period, indicating good stability of the formulation.

RESULTS AND DISCUSSION :

The formulated herbal shampoo exhibited acceptable organoleptic characteristics, including a pleasant odor, smooth texture, and semisolid consistency, indicating good consumer acceptability. The pH of the formulation was found to be 6, which falls within the ideal range for hair and scalp applications and confirms that the shampoo is mild and non-irritant in nature. Maintenance of an appropriate pH is essential to prevent scalp irritation and hair damage.

The formulation demonstrated good washability and solubility in water, producing a uniform solution without leaving any residue. Adequate and stable foaming behavior was also observed, which is an important quality parameter influencing user satisfaction and cleansing efficiency. These findings are in agreement with previously reported herbal shampoo formulations[10],[11].

The antimicrobial evaluation revealed that the herbal shampoo exhibited significant antibacterial activity against *Staphylococcus aureus* and *Escherichia coli*. At higher concentrations, the zones of inhibition were comparable to that of the standard drug streptomycin, indicating strong antibacterial potential of the formulation. Moderate antifungal activity was also observed against *Malassezia furfur*, a microorganism commonly associated with dandruff and scalp disorders.

The observed antimicrobial activity may be attributed to the synergistic action of bioactive phytoconstituents present in *Cyperus rotundus*, along with other herbal ingredients such as Reetha, Ashwagandha, and Brahmi, which are known to possess antimicrobial and scalp-protective properties[12],[13]. The combined effect of these herbal components enhances the overall therapeutic efficacy of the formulation, making it suitable for managing dandruff and maintaining scalp health.

Figure 6: Zone of inhibition against Escherichia coli

Figure 7: Zone of inhibition against Staphylococcus aureus

Figure 8: Antifungal activity against Malassezia furfur

CONCLUSION :

The present study was aimed at the formulation and evaluation of a polyherbal shampoo using selected medicinal plant ingredients. The formulated shampoo demonstrated acceptable physicochemical properties, including suitable pH, good washability, solubility, foaming stability, and favorable organoleptic characteristics. The formulation also exhibited significant antibacterial activity against *Staphylococcus aureus* and *Escherichia coli* and moderate antifungal activity against *Malassezia furfur*, indicating its potential in managing dandruff and scalp-related disorders.

The findings suggest that the developed herbal shampoo is safe, effective, and suitable for regular hair care applications. Further studies involving long-term stability testing and clinical evaluation may be conducted to confirm its therapeutic efficacy and commercial applicability.

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