Anti-Dandruff Herbal Shampoo Using Amla, Reetha, and Shikakai: A Comprehensive Review

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***Abstract*— Dandruff is a chronic scalp disorder characterized by excessive shedding of corneocytes, itchiness, and irritation. Synthetic anti-dandruff agents such as ketoconazole, zinc pyrithione, and selenium sulfide are effective but associated with side effects including scalp dryness, hair discoloration, and irritation. Consequently, herbal formulations have emerged as safer alternatives. Among traditional Indian herbs, Amla (Phyllanthus emblica), Reetha (Sapindus mukorossi), and Shikakai (Acacia concinna) are widely recognized for their cleansing, conditioning, and antimicrobial properties. This review summarizes their phytochemical constituents, mechanisms of action, anti-dandruff potential, formulation strategies, and evaluation parameters for developing an effective herbal shampoo.**

***Index Terms*— Herbal Shampoo, Anti-dandruff, Amla, Reetha, Shikakai, Herbal Cosmectics**

I. INTRODUCTION

Human hair is an essential component. It is a fundamental aspect of human attractiveness. Sebum generation, apocrine sweat, pheromones production, thermoregulation, and protection from environmental aggressors are just a few of the many roles that human hair plays [1]. Hair care products which come under cosmetic; A cosmetic is a product used to cleanse, beautify, increase attractiveness, or change one's look. It derives from the Greek term "Kosmeticos," which refers to the preparation employed for this purpose and applied to the human body or any portion of it. The hair care products are daily tools used to clean the scalp and hair, often used as beautifying agents which are designed to remove dirt, oil, and dandruff from hair and scalp, providing nourishment and a healthy appearance. Dandruff is a common scalp condition affecting nearly 50% of the global population. It is primarily associated with the colonization of Malassezia species, excessive sebum production, and abnormal keratinocyte turnover. The limitations of conventional anti-dandruff shampoos have renewed interest in herbal cosmetics, which are generally considered safer, biocompatible, and environmentally friendly. Amla, Reetha, and Shikakai have been used traditionally in Ayurvedic hair care formulations for centuries. Their combined use offers synergistic benefits such as cleansing, strengthening, antifungal action, and improved hair texture. Therefore, developing a herbal shampoo based on these ingredients represents a natural alternative to synthetic products.

Fig: 1- Structure of the hair

Challenges in Herbal Shampoo Formulation:

- Batch-to-batch variation of plant materials
- Stability issues with natural extracts
- Lower foam compared to synthetic detergents
- Need for standardization of active constituents
- Risk of microbial contamination if not preserved properly

Dandruff: Etiology and Pathophysiology:
Dandruff is categorized as a mild form of seborrheic dermatitis. Its pathophysiology involves three major factors:

1. Proliferation of Malassezia fungi – triggers inflammation and scalp flaking.
2. Sebaceous gland activity – provides lipids that serve as nutrients for dermatophytes.
3. Individual susceptibility – includes impaired barrier function and immune response.

Common symptoms include white flakes, pruritus, and scalp dryness. Untreated dandruff may progress to hair thinning and persistent scalp irritation.

- Advantages:
  - It has only organic and pure ingredients
  - It has no negative side effects
  - It excludes surfactants like SLS
  - It must be skin-friendly
  - There can be no animal testing.
- Limitations of Synthetic Anti-Dandruff Agents:
  - Although synthetic agents exhibit strong antifungal activity, they possess certain drawbacks:
  - Scalp irritation and burning sensation
  - Hair roughness and dryness
  - Disruption of natural scalp microbiota
  - Environmental accumulation of chemicals
  - Costly formulations

II. TYPES OF SHAMPOO

Shampoos have advanced from basic cleaning agents to multipurpose formulas that address various hair types, scalp problems, and consumer preferences. The desire for customised hair care has resulted in the creation of diverse formulations, each designed with particular components and classified according to composition, functioning, and intended demographic. And those are mentioned below; Conventional Shampoo, Medicinal Shampoo, Solid shampoo, Powder shampoo, Cream shampoo, Jelly shampoo, Aerosol Shampoo, Clear Liquid shampoo, Gel Shampoo, Liquid Cream Shampoo, Medicated Shampoo, Shampoo with conditioner (2 in 1 shampoo), Baby shampoo, Sulphate free shampoo, Dry shampoo, Shampoo bars, Colour protect shampoo, Everyday shampoo, Professional shampoo and Shampoos for different types of hair.

Conventional Shampoo: The predominant cosmetic product for hair care is shampoo. It is aptly characterised as a practical cosmetic formulation used to the hair and scalp to eliminate dirt, environmental contaminants, and residual hair style products [2]

Medicinal Shampoo: A diverse array of plants is utilised in shampoos, providing advantageous effects on hair due to their content of vitamins, amino acids, sugars, glycosides, phytohormones, bioflavonoids, fruit acids, and essential oils. Efficient techniques for intentionally contaminating hair, subsequently purifying it through various treatments, and assessing the remaining lipids on the hair by gas chromatography [2].

Solid Shampoo: Compared to traditional shampoos, solid shampoos have a few additional advantages. They are easier to carry and have a longer shelf life than liquid formulations because of their higher microbiological stability [2].

Powder Shampoo: This is a dry powder version of this shampoo. When water or other solvents are added to powdered shampoos, the components' activity is decreased, especially if medicinal shampoos are used. These shampoos are no longer in use since they are difficult to apply [2].

Cream Shampoo: A modified kind of clear liquid cream shampoo is referred to as lotion shampoo. Furthermore, solubilising agents like magnesium stearate are employed to dissolve the supplementary opacifier. These shampoos are packaged in a collapsable tube and possess a paste-like consistency. They are exceedingly beneficial in hair salons [3].

Jelly Shampoo: The texture of these is transparent and dense. usually by using a gelling ingredient (cellulose, for instance). It is widely used in beauty parlors and hair salons. Laundry soap can be used either by itself or in conjunction with the primary ingredient, detergent. The amount of detergent used can be changed to get the gel's required consistency. Additionally, gel shampoo is produced by thickening clear liquid shampoo with methyl cellulose [3].

Clear Liquid Shampoo: These are the most commonly used clear liquid preparations. Typically, low-cloud-point detergent is used to make them. These preparations can also make use of alkanol amides. It's possible that some of these shampoos are transparent [2].

Gel Shampoo: These are often created by adding a gelling agent and are thick and translucent. Hair salons and beauty parlors make excellent use of it. The main component is detergent, which can be used either by itself or in conjunction with soap. A gel with the

desired consistency can be produced by adjusting the detergent percentage [3].

Medicated Shampoo: These shampoos, including ones formulated for particular conditions such as seborrhoeic dermatitis and scalp psoriasis, include medicinal compounds that treat problems of the scalp or hair [4].

Herbal Approach to Anti-Dandruff Therapy:

Herbal ingredients contain a wide range of phytochemicals such as alkaloids, flavonoids, tannins, glycosides, and saponins that exhibit antimicrobial, anti-inflammatory, and antioxidant actions. They also improve air quality by nourishing hair roots, preventing hair fall, and maintaining scalp pH. The use of Amla, Reetha, and Shikakai in combination helps create a balanced shampoo with cleansing and therapeutic properties.

Sr.no	Plant Name	Scientific Name	Major Phytochemicals	Pharmacological Roles in Shampoo
1.	Amla	Phyllanthus emblica	Vitamin c, Gaallic acid, Ellagic acid, Emblicanins A&B, Polphenols, Flavonoids	Antioxidant, anti-inflammatory, strengthens hair follicles, reduces scalp irritation
2.	Reetha	Sapindus mukorossi	Saponins, Sugars, Fatty acids	Natural surfactant, cleansing agent, romoves excess sebum, antimicrobial
3.	Shikakai	Acacia concinna	Saponins, Tannins, Vitamins A, D, E, K, Nicotinic acid	Mild cleanser, natural conditioner, maintains scalp pH, anti-dandruff, anti-itch activity.

Table No.1: Phytochemical Constituents of Amla, Reetha and Shikakai

Sr.no	Parameter	Amla	Reetha	Shikakai
1.	Antifungal Action	Inhibits Malassezia through polyphenols	Saponins disrupt fungal membranes	Tannins inhibit fungal colonization
2.	Anti-inflammatory Action	Reduces scalp Inflammation	Mild soothing effect	Calms itching &irritation
3.	Cleansing Activity	Minimal Cleansing	Primary natural Surfactant	Mild cleansing, prevents dryness
4.	Conditioning Effect	Strengthens hair roots	Mild conditioning	Excellent natural conditioner
5.	Sebrum Control	Regulates scalp oil	Removes excess sebum	Maintains Scalp balance

Table No.2: Mechanism of Anti-Dandruff Action of Key Ingredients

III. LITRATURE REVIEW

Dandruff is one of the most prevalent scalp disorders worldwide, affecting nearly half of the adult population and characterized by excessive flaking, itching, irritation, and scalp dryness. Its pathophysiology is multifactorial and primarily associated with the overgrowth of Malassezia species, alterations in sebum secretion, and an inflammatory response to lipid metabolism by-products on the scalp. Conventional antidandruff treatments such as ketoconazole, zinc pyrithione, and selenium sulfide are effective but may cause adverse effects including dryness, irritation, or long-term sensitivity, prompting increased demand for herbal and mild scalp-care alternatives. Among various herbal combinations studied for scalp disorders, the blend of Amla (Phyllanthus emblica), Reetha (Sapindus mukorossi), and Shikakai (Acacia concinna) has gained significant attention due to its synergistic cleansing, antimicrobial, antioxidant, and scalp-conditioning properties.Amla is widely recognized for its rich content of vitamin C, polyphenols, tannins, and flavonoids. These phytoconstituents provide potent antioxidant and anti-inflammatory activities that help protect scalp cells from oxidative stress and reduce irritation. Several in-vitro studies have reported that Amla extracts exhibit inhibitory effects against dandruff-causing fungi, including Malassezia species, suggesting that its polyphenolic compounds disrupt fungal growth and reduce microbial colonization on the scalp. Furthermore, Amla enhances hair strength, reduces hair fall, and nourishes follicles, making it a valuable ingredient in multifunctional herbal shampoos. Reetha, commonly known as soapnut, is an abundant natural source of saponins biologically active surfactant molecules capable of foaming, emulsifying oils, and cleansing without damaging the

hair cuticle. Its natural cleansing action assists in the removal of sebum, dirt, and keratinous debris, which is essential because excessive oil often favors Malassezia proliferation. Studies evaluating Reetha's saponin extracts have demonstrated good foaming capacity, mildness on skin, and moderate antimicrobial properties, making it an ideal natural surfactant base for herbal shampoo formulations.Shikakai is traditionally used as a gentle hair cleanser and conditioner, known for its saponins, flavonoids, and tannins, which support both scalp hygiene and hair manageability. It possesses notable antimicrobial and antifungal activity, though evidence specifically against Malassezia is variable and requires further study. However, its ability to reduce scalp irritation, prevent dryness, and improve hair texture has been consistently documented. When Shikakai is blended with Amla and Reetha, the combination provides balanced cleansing, nourishment, and protection, making it suitable for individuals seeking a natural alternative to chemical-based shampoos. This synergy is particularly beneficial because dandruff management requires not only antifungal action but also gentle cleansing and scalp conditioning.Formulation studies published in recent years have explored different extraction methods aqueous, ethanolic, and hydroalcoholic to maximize saponins and polyphenols from these herbs. Research shows that Reetha and Shikakai yield higher saponin content in aqueous extracts, while Amla produces greater total phenolic content in hydroalcoholic extracts. Many evaluations have assessed pH, viscosity, foam stability, surface tension, solid content, and cleansing ability of polyherbal shampoos containing these ingredients. Most formulations maintain a pH between 5–6, considered ideal for the scalp and hair cuticle. Antifungal screening through agar-well diffusion and MIC assays indicates that Amla and Shikakai extracts reduce fungal growth, whereas Reetha primarily supports cleansing and may enhance the penetration of active compounds due to its surfactant nature. Several small human volunteer studies have reported improvements in flaking, itching, and overall hair feel when using Amla–Reetha–Shikakai shampoos for 4–8 weeks, although larger randomized clinical trials are still lacking.Safety assessments show that these botanicals are generally well tolerated, though plant extracts may cause allergic reactions in sensitive individuals, making preservative selection and patch testing necessary during product development. Unlike synthetic antidandruff agents, herbal shampoos are perceived to be mild, environmentally safe, and suitable for long-term use. However, standardization remains a challenge because the concentration of active phytochemicals in herbal extracts can vary significantly based on plant source, extraction method, and storage conditions. For broader acceptance in therapeutic or cosmeceutical markets, herbal shampoo formulations require systematic standardization, stability testing, and clinical validation.Overall, the combination of Amla, Reetha, and Shikakai presents a scientifically promising and traditionally trusted approach to antidandruff therapy. Amla contributes antifungal, antioxidant, and anti-inflammatory benefits; Reetha offers natural surfactant and sebum-cleansing properties; and Shikakai enhances conditioning and provides additional antimicrobial effects. Existing literature strongly supports their individual and collective roles in improving scalp health, reducing microbial load, and offering a gentle yet effective cleansing mechanism. Although current evidence is largely based on in-vitro and small-scale studies, the results suggest that this herbal blend could serve as a safe, effective alternative to chemical-based antidandruff shampoos, with future research required to establish standardized formulations and confirm clinical efficacy through larger trials.

IV. FORMULATION

1. Shikakai

Biological Source: Acacia concinna

Synonyms: Soap pod, Fruit for hair

Fig. No.: 2 -Shikaki

Activity: Shikakai is a natural cleanser due to its high saponin content, which creates a mild lather that effectively removes dirt and oil without stripping the scalp of natural oils. It also acts as a detangler and conditioner, leaving hair soft and manageable [5]

2. Reetha (Soapnut)
Biological Source: Sapindus mukorossi
Synonyms: Soapnut, Arishtak

Fig.no.: 3-Reetha

Activity: Reetha contains natural surfactants (saponins) that produce gentle foam and cleanse the scalp and hair. It has antimicrobial and anti-inflammatory properties, making it effective against dandruff and scalp infections [6]

3. Amla (Indian Gooseberry)
Biological Source: Phyllanthus emblica
Synonyms: Amlaki, Emblic Myrobalan
Activity: Amla is rich in Vitamin C and

Fig.no: 4-Amla

antioxidants. It strengthens hair roots, prevents premature greying, reduces hair fall, and promotes healthy hair growth. Its antiinflammatory and antifungal actions also support scalp health [7].
Preparation Method:
1. Extracts of Amla, Reetha, and Shikakai are prepared via decoction or ethanolic extraction.
2. Reetha extract is used as the main surfactant base.
3. Other extracts are incorporated with constant stirring.
4. Thickener is added to adjust viscosity.
5. pH is adjusted to 5–6.
6. The final formulation is filtered, packed, and labeled.

Sr.no	Ingredient	Function
1.	Amla extract/powder	Anti-dandruff, Antioxidant, scalp protection
2.	Reetha extract/powder	Natural surfactant, cleansing agent
3.	Shikakai extract/powder	Conditioner, detangler, pH balancer
4.	Distilled water	Solvent
5.	Xanthan gum /HPMC	Thickening agent
6.	Tea tree oil/Neem oil	Added antifungal activity
7.	Sodium benzoate/potassium sorbate	Natural preservative
8.	Citric acid	PH adjustment
9.	Perfume (mild)	Aroma

Table no.3: Formulation Components for Herbal Anti-Dandruff Shampoo

V. EVALUATION TEST

A number of assessment criteria are evaluated in order to guarantee the herbal shampoo's effectiveness, safety, and acceptance. Standardizing the formulation, verifying the stability of the product, and evaluating its performance all depend on these tests.
1. Organoleptic Assessment

First, the prepared shampoo is assessed for physical attributes like:
Color: It should be consistent and eye catching.
Odour: It should smell nice and herbal, not artificial or unpleasant.
Look: It should be uniform in appearance, devoid of any lumps or separation.

Texture: Depending on formulation, it might be slightly viscous or smooth and gel-like [13].

2. Measurement of pH

One important factor influencing scalp compatibility is the shampoo's pH.

Method: The pH of a 10% shampoo solution (shampoo diluted in distilled water) is measured using a digital pH meter.

The ideal range is between 4.5 and 6.5 to avoid dryness or irritation and to match the pH of the scalp naturally [14].

3.Measurement of Viscosity

The consistency and simplicity of use of the shampoo are determined by its viscosity. Method: Measured using an appropriate rotating viscometer or a Brookfield viscometer. Note: The thickness of the shampoo should be reasonable, meaning it shouldn't be too thick or runny [14].

4. Foaming Ability and Foam Stability

Foaming capacity gives an idea of cleansing efficiency.

Method: Shake test—1 gm of shampoo is mixed with 20 mL of distilled water in a graduated cylinder and shaken vigorously.

Foam Height Measurement: The height of foam is measured immediately and again after 5 minutes to check foam stability [15].

5. Dirt Dispersion Test

This test checks whether the shampoo can hold dirt in the foam and prevent it from redepositing on the hair.

Method: A drop of India ink is added to the shampoo solution. The mixture is shaken and observed.

Result Interpretation: If the ink remains in the foam, it indicates poor dirt dispersion. If the ink moves to the water layer, it signifies good cleansing efficiency [16].

6. Surface Tension Measurement

Lower surface tension enhances wetting and spreading properties of shampoo.

Method: A stalagmometer or drop-counting method is used to calculate surface tension.

Ideal Value: Should be significantly lower than pure water (72 dynes/cm), ideally around 35– 40 dynes/cm.

7. Wetting Time Test

This test determines how quickly the shampoo wets hair strands or wool threads.

Method: A 1% shampoo solution is prepared. A standard wool thread is dropped into it, and the time taken to sink is recorded.

Shorter Time = Better Wetting.

8. Solid Content Determination

This reflects the concentration of active ingredients.

Method: 4 g of shampoo is evaporated in a dish at 105°C until a constant weight is achieved.

Ideal Result: Should be between 20–30% solid content.

9. Conditioning Performance

This test evaluates the after-feel, smoothness, shine, and ease of combing post-application.

Method: A trained panel or volunteers assess hair feel after drying.

Parameters: Detangling ease, softness, non-sticky finish, and natural shine are rated

10. Microbial Load Test

Ensures that the herbal formulation is free from microbial contamination.

Method: Total plate count method is used to identify and quantify microbial colonies.

Requirement: Should comply with pharmacopeial limits for topical products [8-12].

Sr.no	Test Parameter	Description
1.	pH	Should be 5.0-6.0to maintain scalp health
2.	Viscosity	Determines flow, Consistency,spreadability
3.	Foam Height&Stability	Measures cleansing and surfactant effiency
4.	Solid Content	Indicates formulation purity and stability
5.	Surface Tension	Should be low for good cleansing action
6.	Dirt Dispersion Test	Indicates ability to remove dirt without oil spreading in foam
7.	Wetting Time	Lower value indicates good penetration ability
8.	Anti-fungal test	Activity against candida
9.	Irritation study	Ensures formulation is non- irritant
10.	Stability Study	Evaluated under different temperatures &conditions

Table no.4: Evaluation Parameters for Herbal Shampoos

Sr.no	Parameter	Amla	Reetha	Shikakai
1.	Hair Strengthening	Excellent	Moderate	Good
2.	Foaming Ability	Low	High	Moderate
3.	Conditioning	Moderate	Mild	Excellent
4.	Anti-dandruff Activity	Strong	Moderate	Strong
5.	Scalp Soothing	High	Mild	High
6.	Compatibility in formulations	Very good	Very good	Very good

Table no.5: Comparative Benefits of Amla,Reetha, and Shikakai in Shampoo Formulations

VI. FUTURE PROSPECTS

Standardization of herbal extracts, incorporation of advanced extraction technologies, and the development of nano-based herbal formulations may enhance the efficacy of herbal shampoos. Clinical trials, safety studies, and optimization of formulations will help in producing scientifically validated, market-ready herbal anti-dandruff products.

VII. CONCLUSION

The combination of Amla, Reetha, and Shikakai offers a promising natural alternative for anti-dandruff therapy. Their synergistic antifungal, cleansing, and conditioning actions make them suitable for formulating a safe, effective, and eco-friendly herbal shampoo. With increasing consumer demand for herbal cosmetics, these ingredients hold significant potential for commercial shampoo formulations.

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