International Journal of Pharmaceutical research and Applications
Volume 11, Issue 5, Sep.-Oct.2026,pp:1181-1192 www.ijprajournal.com ISSN:2456-4494

Formulation, Evaluation and Market Comparison of Herbal Anti-Dandruff Shampoo

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Date of Submission: 13-10-2026 Date of Acceptance: 25-10-2026

ABSTRACT

Shampooisoneofthemostcommonformsofhaircleanser havebeenused forcleansing thescalp.Thepurposeofusingshampooistoremovedirtt hatisbuiltuponthehairwithouttaking outmuchofthesebum.Inthepresentscenario,synthetics hampoohasadversesideeffectslike dryness of hair and keratin loss on the scalpsotheincorporationofherbal botanicals to formulate herbal shampoo could prove to be a forthcoming alternative.Itseemsimprobablethatherbalshampoo, although better in performance and safer than synthetic ones, will be popular with consumers.Thestudyaimedtoformulateaherb-infusedshampoo by using natural ingredients like (*Sapindus mukorossi, Azadirachta indica, Trigonella foenum-graecum,Hibiscus rosa-sinensis*, *Cocos nucifera*) base, and preservativesandtoevaluateandcompare its physicochemical properties with the marketed herbal shampoos.In the current paper we have formulated, characterized and performed a market comparison of our herbal creambased shampoo and the results showed favorable organoleptic characteristics cleansing action, dispersity and foaming ability.

KEYWORDS

Herbalshampoo,*Sapindusmukorossi,Azadirachtaindica,Trigonellafoenum-graecum*,Hibiscus, coconut oil

I. INTRODUCTION

Aliquidorcreamofsoap, powderordetergenttowashthehairis calledshampoo.Shampooisahaircare product, typically in the form of a viscous liquid that is used for cleansing hair. Nowadays many synthetic, herbal, medicated, and non-medicated shampoos are available in the market but the popularity of herbal shampoos among consumers is on the rise because of their belief that these products being of natural origin are comparatively safe and free from side effects. Herb-infusedformulationsareconsideredasanalternativetosy ntheticbutformulatingcosmetics using completely natural raw material is a difficult task [1]. There are large numbers of medicinal plantsthatarereportedtohavebeneficialeffectsonhairan darecommonlyusedintheformulation of shampoo. These plant products may be used in their powdered form, crude form, purified extracts, or derivative form. It is extremely difficult to prepare a herbal shampoo using a single naturalmaterialthatwouldbemilderandsaferthanthesyn theticones,andatthesametimewould compete favorably with its foaming, detergency, and solid content. We, therefore, considered formulating a herb-infused shampoo using traditionally and commonly used plant materials for hair washing in India [2].

	ADVANTAGES	DISADVANTAGES
1	Nourishesandstrengthens hair	Excessiveuse canmake hairbrittle
2	Cleansethescalp andhair	Cancause buildup
3	Stimulateshair growth	Productuniformity and quality control.
4	Reduceshairfall	Varyinginconsistency
5	Givesshineto hair	Sessionalvariationofplantconstituents
6	Noanimaltesting	

Table 1: Advantages and Disadvantages of Shampoo [2,3]

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Volume 11, Issue 5, Sep.-Oct.2026,pp:1181-1192 www.ijprajournal.com ISSN:2456-4494

TYPESOF SHAMPOO

A) Basedon Appearance

- Powdershampoo
- Liquid shampoo
- Gel shampoo
- Creamshampoo

B) Basedon function

- Conditioning shampoo
- Clarifying shampoo
- Babyshampoo
- Therapeuticshampoo

C) Basedon origin

- Herbal
- Synthetic
- Egg

II. MATERIALSAND METHODOLOGY

Herb-infused shampoo can beformulatedusing avariety ofnatural ingredients such as herbs, essential oils, carrier oils, and natural cleansers. Some common herbs used in herb-infused shampoos include rosemary, reetha, hibiscus, lavender, and sage. These herbs are known to nourish hair, soothe the scalp, and promote hair growth. Carrier oils like coconut oil, olive oil, and jojoba oil can also be used to hydrate and moisturize hair, while natural cleansers like castile soap or aloe vera gel can help cleanse the hair without stripping it of its natural oils.An amalgamation of all these agents in a single formulation can help in cleansing hair as well as managing manifestations of hair loss and dandruff like conditions.Theingredientswhichareusedinthisformulationare Reetha,Hibiscus,Methi,Neem,Coriander, and coconut oil.

Ingredients	Biological Source	Phytoconstituents	Uses	References
Lavenderoil	*Lavandula angustifolia*	Includinglinalool,linalylacetate,lavandulol, lavandulylacetate,terpinen-4-ol,andcamphor.	Potentiallysoothesandnourishthe skin	[3,4]
Coconutoil	*Cocosnucifera*	Medium-chainfattyacidssuchaslauricacid,caprylic acid,andcapric acid.Italsocontainsantioxidants,vitaminsEandK,andmineralssuchasiron.	Strengthens Hair follicles	[4,5]
Hibiscus	*Hibiscusrosea*	Bioactive compounds such as flavonoids, anthocyanins, organic acids, and polysaccharides. The flowers of hibiscus arerich in vitaminC and minerals such as calcium, magnesium, and iron.	It is known for its ability topromotehealthyhairandskin.Hibiscusoil canbeusedto improvebloodcirculationandpromotehair growth.Hibiscusleavesandflowerscanalsobeused in hair masks to nourish and strengthen hair, reduce hair fall, and prevent dandruff	[5,6]
Coriander	*Coriandrumsativum*	Bioactivecompoundssuchasfattyacids,essentialoils,flavonoids,and phenolicacids.Theseedsandleavesofcoriandererichinvitaminsandmineralssuchas vitamin C, vitamin K, calcium, potassium, and magnesium.	Coriander contains essential oils and fatty acids that help to nourish the hair and scalp, making it avaluableingredientinhaircareproducts.	[6]
Methi	*Trigonella foenum-graecum*	Severalbioactivecompoundssuchassapon ins,flavonoids,alkaloids,andsteroids. The seeds are a rich source of protein, dietary fiber, and minerals such as iron, calcium, phosphorus,andpotassium.Methiseedsalsocontaintrigonelline,4-hydroxyisoleucine,diosgenin, and	Methi seeds contain proteins and nicotinic acid, which help to stimulate hair growth and prevent hairloss.Theseedsalsocontainlecithin,whichhydratesandstrengthenshair,makingitlessprone tobreakage.Methiisalsorichinantioxidants	[7]

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		galactomannan	,whichhelpto protecthairfromdamage caused by free radicals.Methiisalsoknownforitsanti-inflammatory, antioxidant, and antimicrobial properties.	
Neem	*Azadirachta indica*	Biologically active compounds such as nimbin, nimbinin, nimbolide, nimandial, nimbolinin, nimocinolide, gedunin, salannin, azadirachtin, and quercetin. The leaves contain flavonoids like quercetin, kaempferol, and myricetin. The bark contains tannins, flavonoids, and triterpenoids. The seeds contain a fixed oil, which is rich in oleic, stearic, and linoleic acids.	Neem hasanti-fungal,anti-bacterial,andanti-viralproperties	[8]
Reetha	*Sapindus trifoliatus*	fruit of Reetha contains saponin (10-11.5%), sugar (10%), and mucilage. The saponin in Reetha is a mixture of 6 sapindosides (A, B, C, D & Mukorozi saponin E1, Y1) such as Dioscin, Protodiscin, Diosgenin, Gitogenin, Chlorogenin & Rusogeni. The seeds of Reetha contain fatty acid B-sitosterol, starch, sugars (10%), mucilage, and protein. The pericarp of Reetha contains 2 new triterpenoid saponin emerginatoside-B&C	Reethaexhibits anti-inflammatory, antimicrobial, and insecticidal activities. It is also used in cosmetic products, suchasahairtonic,duetoitsabilitytocleanse andnourishhairnaturally. Reethacontainsnatural saponins,whichactasanaturalsurfactantandhelptocleansethescalpandhairwithoutstripping away natural oil	[9,13]

Table 2: List of phytochemicals and their utilization in shampoo

EXPERIMENTALWORK

Step1:Preparationofherbalextract

a. 20grams ofthedriedherbalpowder was accurately weighed
b. It was then placed in a beaker. Water was added to herbal mixture in a ratio of 20:80 (herb to water).
c. Mixture was heated toassisttheextractionprocessbyallowingittostandonawaterbathfor boiling until it becomes one-fourth of its original volume.
d. Aftercooling, the mixture was filteredwithfilter papertoseparate the liquidextractfromthe herbal residue.

Step2:Preparationof Base

a. Water,oleic acid,andSLS was blended to form a pasteandheated to 60°C.
b. Slowlytriethanolaminewas added withcontinuous stirring.
c. Preservativeaftercoolingto35°C was added.

Step3:Preparationofherb-infusedshampoo

a. Graduallyherbalextractswere added totheshampoobasewhilestirringcontinuously toensure even distribution.
b. It'simportanttoaddthe extractsslowlyandmixthoroughlytopreventseparation[10-12].

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Fig. 1 -Herbalextract

Fig. 2–BaseandHerb-infusedShampoo

Formulation Table:

Ingredients	F1gm	F2gm	F3gm
Reetha	5.33	7.33	8.33
Neem	3.1	3.66	6.66
Coriander	3.27	5.34	6.34
Hibiscus	4	6	5.34
Coconutoil	5	3	3
Fenugreek	4.33	4.67	5.33
Base	25	20	15

Table3 Trialanderrorbatchesof formulation

F1 Batch	The phase was separated, andtextureandodorwere also poor so the formulationwasunstable.	
F2 Batch	The formulation had clumps so may lead to microbialcontamination.	
F3 Batch	Theformulationwas stable andhadagoodcreamy texture.	

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OPTIMIZEDFORMULATION TABLE

Sr. No	Ingredients	Quantitytaken (50g)	Medicinaluses
1	Reetha	8.33	Foamingagent
2	Neem	6.66	Anti-bacterialagent
3	Coriander	6.34	Nourishment
4	Fenugreek	5.33	Anti-dandruffagent
5	Hibiscus	5.34	Promotehairgrowth
6	Coconutoil	3	Conditioningagent
7	Base	15	Vehicle
8	Lavenderoil	3-4drops	Soothingeffect &Fragrance

Table4Optimizedformulationtable

Evaluation and Characterization

Physicalappearance/visualassessment:
Theformulationspreparedwereevaluatedintermsoftheirclarity,color,odor,&texture[13].

DeterminationofpH(PotentialofHydrogen):
pHisoneofthewaystominimizedamagetothehair.Mildacidityprevents swellingandpromotes tighteningofthescales,therebyinducingshine.ThepHof 10%v/vshampoosolutionindistilled water was measured by using a Digital pH meter [14].

Determinationpercentagesolid content:
ACleandryChinadishwasweighed,and4gramsofshampoowasaddedtoit.Theweightofthe dish and shampoo was noted. The exact weight of the shampoo was calculated. Place the China dish with herbal shampoo on a hot plate until the liquid portion has evaporated. The weight of shampoo (solids) after drying was calculated [15,16].

Percentageofsolidcontent[17]:−

$$\frac{\text{Netweightofshampoo}}{\text{Totalweightofshampoo}} \times 100$$

Foamingabilityandfoamstability:
Foamingabilitywasdeterminedbyusingthecylindershakemethod.50mLofthe1%formulated shampoosolutionwasplacedintoa250mLgraduatedcylinder;itwascoveredwithonehandand shaken 10 times. The total volume of the foam contents after 1 minute of shaking. The foam volume was calculated only. Immediately after shaking the volume of foam at 5-minute intervals was recorded[18].

Dirtdispersion:
Two drops of shampoo were added to a large test tube containing 10 ml of distilled water. One drop of ink was added to the test tube, was stopped, and shaken ten times. The amount of ink in the foam was estimated as none, light, moderate or heavy[19].

Washability:
The formulation was applied on the skin and then the ease and extent of washing with water was checked manually[20].

Wettingtimetest:
Acanvaspaperwascutinto1-inchdiameterdiscshavinganaverageweightof0.44g.Thesmooth surfaceofthediscwasplacedonthesurfaceof1%v/vshampoosolutionandthestopwatchstarted. The time required for the disc to begin to sink was noted down as the wetting time[21].

CleansingAction:
Cleaning action was tested on solid human hair in grease. Take 5 grams of solid human hair in grease,placethehairinaflaskcontaining200mlofwater,andadd1gmofformulatedshampoo. Shake the flask50 times per minutefor4 minutes. This process helps remove dirt and impurities fromthehair.Aftershaking,washthehaironceagainwith sufficientwater.Removethehairfrom the flask. Filter out any remaining shampoo solution. Dry the hair and weigh it[22,23].

DP=(1-T/C)100
Inwhich,DPisthepercentageofdetergencypower, C is the weight of sebum in the control sample and T is the weight of sebum in the test sample.

Stability Studies
Stability studies must be performed by keeping the formulation at 75 %RH and 45°C for 1 month.

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III. RESULTAND DISCUSSIONS

PARAMETER	FORMULATED SHAMPOO		MARKETED SHAMPOO	
Color	Brown		Lightyellow	
Odor	Pleasant		Pleasant	
Texture	Creamy		Creamy	
pH	7.4		4.85	
%SolidContent	28.45%		22.7%	
FoamingStability	0 min	15	0 min	12
	5 min	12	5 min	10
	10 min	8	10 min	6.5
	15 min	4	15 min	3.8
Dirt Dispersion	Moderate		Moderate	
Washabilitytest	Good		Good	
Wettingtime	154 sec		140 sec	
Cleansing Action	24%		32%	

Table5: PhysicochemicalEvaluationofFormulatedandMarketedShampoo

IV. DISCUSSIONS

Formulation of herb-infused shampoo by using plant extracts of Reetha, Methi,Neem,Coriander,andHibiscus was formulated and characterized.Wetriedtooptimizetheformulationbyformulatingthreebatches. The first batch (F1) failed due to phase separation because coconut oil has more density than aqueousextract.Thesecondbatch(F2)failedduetoHibiscushavingamucilaginousnaturewhich mixedwithwater,potentiallyleadingtoclumpsifnotproperlydispersed.Thethirdbatch(F3)had shownbetterresultsascomparedtotheothertwobatches. Thevariousqualitycontrolparameters like physical appearance/visual inspection, pH, % Solid contents, Foam ability and Stability, and Dirt dispersion, were checked. All parameters gave favorable results for the herb infused shampoo. The result obtained in the presentstudyshowsthattheactiveingredientsofthesedrugswhenincorporatedinshampoogive more stable products with good aesthetic appeal.

Physicalappearance/visual inspection:
Theformulatedandmarketedshampooswereevaluatedforphysicalcharacteristicssuchascolor, odor, and texture (Table 5). Our prepared shampoo was brown, creamy texture and had a good odor. No significant difference was observed in terms of odor, transparency, and foaming characteristics between commercial and formulated shampoo except for color.

Fig. 3Physical comparison Formulatedshampoo&MarketedShampoo

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Determination of pH:

ThepHbalanceoftheproductisimportantasitaffectstheskinandthesurfaceonwhichthereare used.ThepHofformulatedshampooandmarketedshampoowereandarepresentedin(Table 5). Theideal pH of shampoo falls between the range of (7 and 5). The pH of the shampoo also helps in minimizing irritation to the eyes, enhances the qualities of hair, and maintains the ecological balance of the scalp.

Fig. 4 Determinationof pH a) formulated shampoo b) market shampoo

DeterminationofPercentagesolid contents:

Goodshampoosusually have20%–30%solidcontentasitiseasyto apply andrinseout fromthe hair. If it doesn't have enough solid it will be too watery and wash away quickly, similarly too many solids will be hard to work into the hair or too hard to wash out. So, the solid content of formulated shampoo and marketed shampoo was found to be within the range[23].

Formulatedshampoo	**Marketedshampoo**
%ofsolid content Netweightofshampoo x100 Totalweightofshampoo 1.138 = x100 4 =0.2845x100 =28.45%	%ofsolid content Netweightofshampoo = x100 Totalweightofshampoo 0.908 = x100 4 =0.227x100 =22.7%

Fig. 5 Determinationofsolid% content a) formulated shampoo b) market shampoo

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Foamingabilityandfoam stability:
One of the essential parameters in evaluating a shampoo is lathering or mostly described as foaming. The formulated herbal shampoo resulted in the formation of small-medium, dense, and uniform type of foam. The foam volume remained unchanged during a 5-minute period which suggests that the produced foams have good stability. The results are shown in (Table 5)[24,25].

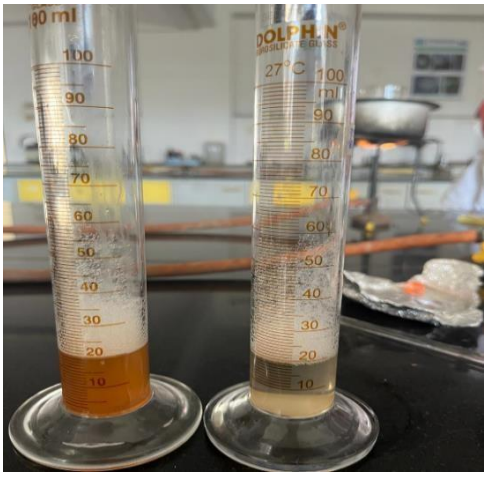
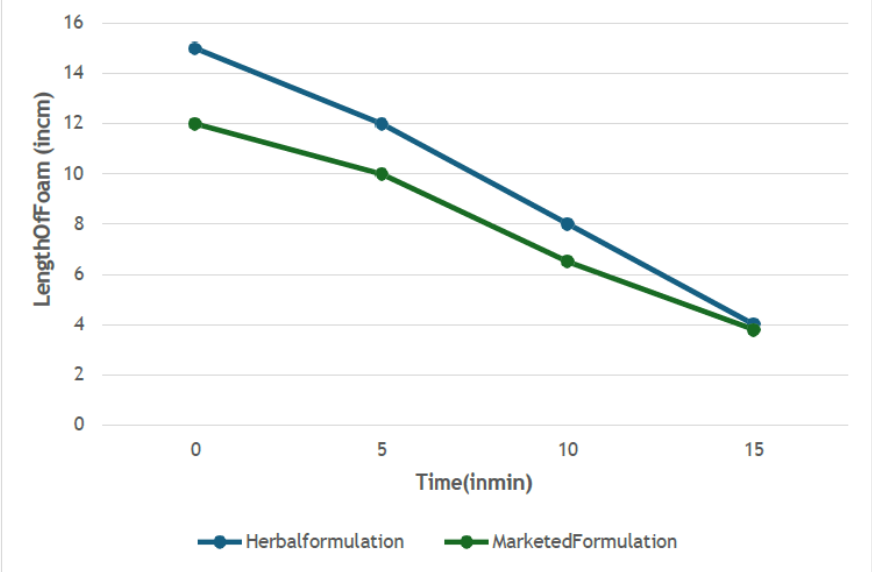


Fig. 6 FoamStability a) formulated shampoo b) market shampoo



Dirtdispersion:
Dirt dispersion is an important criterion for the evaluation of the cleansing action of shampoo. Shampoosthatcausetheinktoconcentrateinthefoamare consideredofpoorqualitybecauseink ordirtthatstaysinfoamisdifficulttorinseawayandgetsre -depositedonthehaircleansingaction. Allshampooconcentratedtheinkinthewaterportion,ens uringtheirsatisfactorycleaningability and actual effectiveness. The results are shown in (Table5)[26-28].

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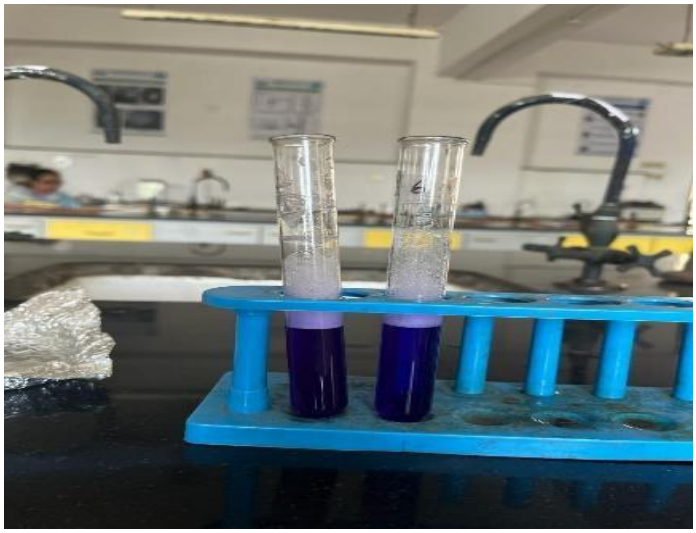

Fig. 7DirtDispersion a) formulated shampoo b) market shampoo

Wetting time:

Thewettingabilityofasurfactantisdependentonitsconcentrationandiscommonlyusedtotest its efficacy. The canvas disc method is quick, efficient and reliable test to evaluate the wetting abilityofashampoo.Thewettingtimeofformulatedshampooandmarketedshampoowasfound to be 154 and 140 sec respectively as shown in (Table no. 5) It may be concluded that shampoo has good spreading and penetration abilities, which may enhance its cleansing action because shorter the wetting time shampoo will spread more quickly[29].

Fig. 8WettingTime a) formulated shampoo b) market shampoo

Washability:

It's important to wash away the shampoo easily, removing dirt. If the shampoo stays on the hair for a very long time or if it's not washed properly then buildup can occur on the scalp and hairs will become frizzy and damaged.The shampoo is easily washable[29].

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Fig. 9 Washability a) formulated shampoo b) market shampoo

Cleansing Action:

Cleaning action was tested on hair in grease. Although cleaning action primary aim is to remove dirt, experimental detergency evaluation has been difficult to standardize, as there is no real agreementonastandardsoil,areproduciblesoilingprocessortheamountofsoilashampooshould ideally removal. The result of detergency ability when compared the formulated shampoo and marketed shampoo was found between the range of 20 -33 % as shown in (Table no.5)[30].

Formulatedshampoo	**Marketedshampoo**
DP= (1-T/C)100 DP=(1-3.8/5)100 DP= (1-0.76)100 DP= 0.24×100 DP= 24%	DP= (1-T/C)100 DP=(1-3.4/5)100 DP= (1-0.68)100 DP= 0.32×100 DP= 32%

Fig 10 Cleansing action a) formulated shampoo b) market shampoo

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Stability study:
Thestabilityandacceptabilityoforganolepticproperties offormulationsduringthestorageperiod indicated that they are chemically and physically stable. The shampoo was observed for physicochemical changes for 1 month. No change was observed. The shampoo was very stable[28,30].

FUTURE PROSPECTS:

Herbal powder sachets and herbal hair care kits can be designed for better compliance. Personalized skin care is now slowly and steadily gaining a lot of importance and formulating a herb infused shampoo with better characterized parameters can aid in managing hair fall, dandruff as well aa restore the hair quality.

V. CONCLUSION

In this research work a herb-infused shampoowas formulated and evaluated on various characterization parameters.Thepurpose of this study is to provide hair nourishment, and mild foam for cleansing action in the form of combinedherbalextractsi.e.Reetha,Neem,Fenugreek, Coriander,Coconutoil,Hibiscus.Several tests were performed to evaluate and compare the physicochemical properties of both prepared andmarketedshampoos.Favorable results for dirt dispensing, washability, pH, viscosity, and foamability were obtainedOurpreparedshampooshowedcomparableres ultswiththatofmarketed shampoo for quality control tests, but further research and development are required to improve its overall quality.Herbal shampoos can bring in a paradigm shift in the management of various diseases related to scalp and hair health.

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