EJPMR, 2025, 12(11), 101-108 **Research Article** **Impact Factor 7.065**

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

ISSN (O): 2394-3211
ISSN (P): 3051-2573
Coden USA: EJPMAG

FORMULATION AND EVALUATION OF A NOVEL POLYHERBAL HAIR TONIC SHAMPOO

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DOI: https://doi.org/10.5281/zenodo.17471354

How to cite this Article: Divya B. R.*, T. Tamizh Mani, Vageesh Revadigar, L. Shiju, Pavithra T. (2025). Formulation and Evaluation of A Novel Polyherbal Hair Tonic Shampoo. European Journal of Pharmaceutical and Medical Research, 12(11), 101–108.

Article Received on 24/09/2025 **Article Revised on 14/10/2025** **Article Published on 01/11/2025**

ABSTRACT

This study reports the formulation and evaluation of a novel polyherbal hair tonic shampoo prepared from five herbal extracts. The formulations (F1–F5) were assessed for physicochemical properties, pH, viscosity, foam stability, solid content, dirt dispersion, antimicrobial activity, and stability. Results showed all formulations had acceptable quality parameters with effective cleansing ability. Antimicrobial studies confirmed significant activity against *Staphylococcus aureus*, particularly in F4 and F5. Stability testing validated long-term consistency, F4 being the most stable. Overall, the developed formulations, especially F4, can be considered safe, effective, and natural alternatives to synthetic shampoos.

KEYWORDS: Polyherbal shampoo, hair tonic, physicochemical evaluation, antimicrobial activity, stability studies.

INTRODUCTION

Herbal medicines are in great demand and are used by approximately 80% of the world's population. Their widespread use can be attributed mainly to their perceived safety and effectiveness, cultural acceptability, and reduced side effects in comparison to prescription drugs; they are considered to be accessible and cost-effective, perhaps most crucially.[1] Human beauty is inseparable from hair. Since ancient times, individuals have utilized herbs for cleaning, beautifying, and managing hair. As time has gone by, synthetic agents have come to dominate a significant portion of the market. However, today individuals are beginning to recognize their detrimental effects on skin, hair, and eyes. These factors drew the community towards herbal products, which are more affordable and have minimal side effects.[2] The variety of items referred to as "hair cosmetics" are used to maintain the cleanliness of hair. Depending on a person's culture and physical attributes of their hair, several hair care regimens are used, like shampoo, hair dyes, and hair sprays. Cosmetic conditioners help to soften hair, reduce frizz, and make it more manageable. Hydrating products like hair masks and oils nourish dry and damaged hair. Shampoo removes dirt, oil, and product buildup from the scalp and hair.[3] The most usual type of hair treatment is shampooing. Shampoos are mainly designed to clean the hair and scalp. Given the current situation, it appears unlikely that herbal shampoo, despite its superior performance and safety compared to synthetic options, will gain popularity among consumers. One could adopt a more radical approach to popularizing herbal shampoo by shifting consumers expectations of shampoo toward a focus on safety and efficacy. Hair tonic is a hair care product designed to improve the health, appearance, and manageability of the hair and scalp.[4]

MATERIALS AND METHOD

Collection of Plant Material

The plant materials of *Azadirachta indica* seeds, *Alternanthera sessilis*, *Ocimum tenuiflorum* were collected from Devegowdanadoddi village, Maddur taluk, Mandya District, Karnataka, and *Balanite Aegyptiaca*, *Rubus fructicosus* fruits were collected from the Sugandha Kesari raw material Mamulpet, Bangalore in the month of April 2025. The plants were identified and authenticated by Dr. Thejesh Kumar M.P Assistant professor and Head (Botany), Post graduate research

Centre Bharathinagara, Maddur taluk, Mandya district, Karnataka.

METHODOLOGY

Maceration method was carried out by using the closed vessel container. Accurately weigh 200g of powdered dried plants materials separately and then poured into the vessel to that add 1000ml of Hydroalcoholic solvent (50% alcohol and 50% distilled water) soaked for 72hours with occasional shaking. After this period filter the mixture with the help of filter paper. Evaporate the solvent by heating on a water bath until to get a semisolid extract (concentrated extract).

Preparation of Polyherbal Hair tonic Shampoo.[5]

Table 1: Formulation of polyherbal shampoo.

SL.NO.	Ingredients	Purpose	Qty (100%)
1	Triethanolamine lauryl sulphate	Primary surfactant	45%
2	Coconut monoethanolamide	Foam Stabilizer	2%
3	Herbal extract	-	10-15%
4	Xanthan gum	Thickening agent	Q. S
5	Perfume	Flavoring agent	Q. S
6	Colour	Appearance	Q. S
7	Water	vehicle	Q. S

Procedure

Take Triethanolamine lauryl sulphate under constant stirring to avoid excessive foam formation. Then dissolve the Cocamide MEA and herbal extracts (different concentration) in hydro-alcoholic solution(5ml) separately. Then mix it together and adjust the thickness using Xanthan gum slowly by stirring. Then add fragrance and colour with gentle mixing. Adjust pH using Sodium Chloride to around 5.5-6.5.

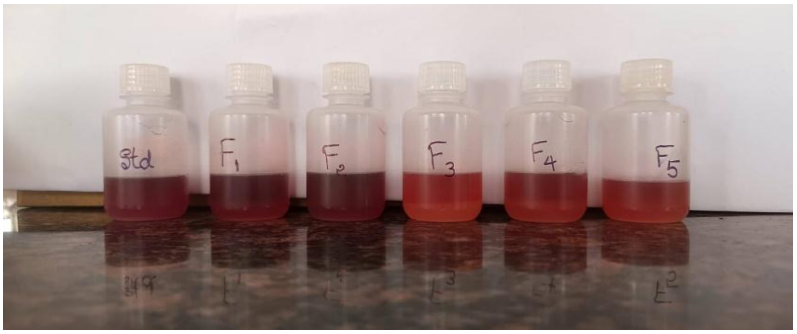

Fig 1: Formulated herbal shampoo.

Table 2: Different concentration of extract used for the preparation of Shampoo(50%).

Herbal ingredients	F1	F2	F3	F4	F5
Azardirachta Indica	1%	1%	1.5%	2%	2%
Alternanthera Sessilis	1%	1%	1.5%	2%	2%
Ocimum Tenuiflorum	1%	1%	1.5%	2%	2%
Balanite Aegyptiaca	1%	0.5%	1.5%	1%	0.5%
Rubus Fructicosus	1%	0.5%	1.5%	1%	0.5%

Evaluation of prepared polyherbal Hair tonic 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.

Physical appearance/visual inspection[6]

The prepared formulations were evaluated for the clarity, colour, odour and foam producing ability and fluidity. To ensure aesthetic and sensory acceptability.

pH[7]

The pH of shampoos has been shown to be important for improving and enhancing the qualities of hair, minimizing irritation to the eyes, and stabilizing the ecological balance of the scalp.

The pH will be calculated using pH meter. The pH will be measured by using 1ml of shampoo into 5 ml distilled water then calculate the pH.

Viscosity[8]

Procedure: The viscosity of the prepared formulations was measured at room temperature using a Brookfield viscometer (R/S plus rheometer model, LV, USA). 100

ml of the tested shampoo was poured in a beaker and an appropriate spindle was immersed into it. Readings were recorded after 5 min. of rotation at a speed of 10 rpm.

Dirt dispersion[9]
Shampoo should remove dirt effectively without foam darkening.

Procedure: In a large test tube, two drops of shampoo will be added to another test tube containing 10 ml of distilled water. To this, 1 drop of Indian ink will be added; the test tube will be stoppered and shaken for 10 times. The amount of ink in the foam will be estimated as None, Light, Moderate, or heavy.

Determination of solid content percentage[10]
Determines total dissolved/undissolved content; should be 20–30% ideally.

Procedure: A clean dry evaporating dish will be weighed and 4 grams of shampoo will add to the evaporating dish. The evaporating dish with shampoo will be placed on the hot plate until the liquid portion will evaporate. The weight of the solid contents present in the shampoo will be calculated after drying.

Foam stability test[11]
Evaluates cleansing efficiency and consumer appeal.

Procedure: The stability of foam will determine by using cylinder shakes method. About 25 ml of shampoo will be taken in 250 ml measuring cylinder and shaken for 10 minutes. The total foam volume will measure after 1 minute and foam stability was determined by recording foam volume from 1 to 4 minute.

Antimicrobial Activity[12,13]
The increasing incidence of drug- resistant pathogens raises an urgent need to identify and isolate new bioactive compounds from medicinal plants using standardized modern analytical procedures. Medicinal plant-derived compounds could provide novel straightforward approaches against pathogenic bacteria. Plants are rich in a wide variety of secondary metabolites, such as tannins, terpenoids, alkaloids, and flavonoids, which are responsible for antimicrobial properties. Determination of Anti-microbial activity of formulated shampoo by agar well diffusion or cup-plate method.

Microorganisms used: *Staphylococcus aureus* were procured from JSS college of Pharmacy, Ooty, India and are used for determining antimicrobial activity.

Preparation of standard: Ciprofloxacin is dissolved in DMSO solution to get the concentration of (5µg/well) and (30µg/well) respectively. Determination of zone of inhibition: Evaluation of antimicrobial activity was carried out by agar well diffusion or cup-plate technique using nutrient agar medium and the antimicrobial activity was measured in terms of zone of inhibition in millimeter (mm).

Preparation of Inoculums: Suspension of organism was prepared as per McFarland standard. 24 hrs old culture was used for the preparation of bacterial suspension. Suspension of organism was made in a sterile isotonic solution of sodium chloride (0.9%w/v) and the turbidity was adjusted such that it contained approximately 1.5X108 cells/ml. It was obtained by adjusting the optical density of the bacterial suspension equivalent to mixture of 0.05ml of 1.175% of barium chloride and 9.95ml of 1% Sulphuric acid.

Agar Well Diffusion Method
Use a sterile cork borer to punch wells (~6 mm diameter) in the agar plate.

Fill the wells with
Test shampoo (various concentrations)
Positive control (e.g., ciprofloxacin)
Incubate the plates at 32–35°C for 5–7 days in a humidified chamber.

Observation & Measurement
After incubation, measure the zone of inhibition (clear zone around the well) in millimetres.

Stability Studies[14]
The stability studies for the polyherbal anti-dandruff formulations will be performed according to ICH guidelines. The formulations will be tested for their physical appearance, % solid content, transparency, and pH.

RESULTS AND DISCUSSION

Evaluation of polyherbal Hair tonic Shampoo
The prepared Herbal Shampoo formulations (Standard, F1, F2, F3, F3, F4, F5) were evaluated for their physicochemical properties and performance parameters. Results are presented below.

Physical Appearance
Table 3: Evaluation of Formulation for physical appearance.

S.No.	Formulation	Color	Odor
1.	F1	Red	Characteristic rose fragrance
2.	F2	Red	Characteristic rose fragrance
3.	F3	Red	Characteristic rose fragrance
4.	F4	Red	Characteristic rose fragrance

5.	F5	Red	Characteristic rose fragrance
6.	Standard	Red	Characteristic rose fragrance

All the formulations exhibited desirable physical characteristics including homogeneity, pleasant odor, and stable red color.

pH

Table 4: Determination of pH.

S.No.	Formulation	Trial 1	Trial 2	Trial 3	Mean
1.	F1	5.7	5.8	5.9	5.8
2.	F2	5.6	5.7	5.8	5.7
3.	F3	6.0	6.1	6.0	6.0
4.	F4	6.2	6.3	6.2	6.2
5.	F5	6.1	6.0	6.2	6.1
6.	Standard	6.4	6.3	6.4	6.4

The pH of the prepared polyherbal shampoo formulations ranged between 5.7 and 6.2, which falls within the ideal range for shampoos (5.0–7.0) and is compatible with the natural pH of the scalp and hair. Among the formulations, F1 and F2 showed slightly acidic values (5.7–5.8), which are closer to the scalp's natural pH, making them milder and less likely to cause irritation. Formulations F3, F4, and F5 exhibited pH values between 6.0 and 6.2, which are also acceptable and comparable to the standard shampoo (6.4). This indicates that all formulations are safe for hair and scalp use, with F1 and F2 being more suitable for maintaining scalp health and preventing dryness or cuticle damage.

Viscosity

Table 5: Determination of Viscosity.

S.No.	Formulation	Trial 1	Trial 2	Trial 3	Mean Viscosity (cP)
1.	F1	2600	2650	2700	2650
2.	F2	2500	2550	2600	2550
3.	F3	2800	2850	2900	2850
4.	F4	3000	3050	3100	3050
5.	F5	3100	3150	3200	3150
6.	Standard	2400	2450	2500	2450

The viscosity of the polyherbal shampoo formulations ranged between 2550–3150 cP, which is within the acceptable range (1000–4000 cP) for cosmetic shampoos. Among the formulations, F1 (2650 cP) and F2 (2550 cP) showed viscosity values close to the standard shampoo (2450 cP), indicating desirable flow properties and ease of application. F3 (2850 cP), F4 (3050 cP), and F5 (3150 cP) exhibited comparatively higher viscosities, which may enhance product stability and lather retention but could reduce spreadability if too high. Overall, the results suggest that all formulations possess suitable viscosity, with F1 and F2 being more comparable to the marketed standard, while F4 and F5 demonstrate thicker consistency.

Foam hight and Foam stability

Table 6: Foam Height and Stability.

S.No.	Formulation	Initial foam height (cm)	Foam Height after 5min (cm)
1.	F1	7.8	7.8
2.	F2	6.5	6.4
3.	F3	8.5	8.5
4.	F4	7.6	7.2
5.	F5	6.9	6.5
6.	Standard	7.0	6.5

The foam stability study showed that all polyherbal shampoo formulations produced satisfactory foaming comparable to the standard. F3 (8.5 cm) and F1 (7.8 cm) maintained their foam height over 5 minutes, indicating excellent stability. F2, F4, and F5 showed slight decreases, while the standard shampoo also reduced from 7.0 to 6.5 cm. Overall, the results suggest that F1 and F3 exhibit superior foam stability, making them more effective in maintaining lather during use.

Solid content determination

$$\%Total\ Solids = B - A/4 \times 100$$

Where,
A=Wight of empty China dish
B= Wight of China dish after evaporation
B-A= Wight of Sample

Table 7: Solid content determination.

S.No.	Formulation	Total solid content			%solid content		
		Trial 1	Trial 2	Trial 3	Trial 1	Trial 2	Trial 3
1.	F1	0.79	0.80	0.81	19.75	20.00	20.25
2.	F2	0.82	0.83	0.82	20.50	20.75	20.50
3.	F3	0.85	0.86	0.84	21.25	21.50	21.00
4.	F4	0.88	0.87	0.88	22.00	21.75	22.00
5.	F5	0.94	0.95	0.94	23.50	23.75	23.50
6.	Standard	0.84	0.83	0.82	21.00	20.75	20.50

The total solid content of the formulations ranged from 19.75% to 23.75%, which falls within the acceptable range (20–30%) for shampoos. F1 and F2 were close to the standard shampoo, indicating an ideal balance between cleansing and foaming ability without leaving residues. F3 and F4 showed slightly higher values, suggesting good formulation stability. F5 exhibited the highest solid content, which may improve viscosity but could risk excess deposition on hair if too high. Overall, the results indicate that all formulations possess suitable solid content, with F2 and F3 being closest to the standard.

Dirt dispersion

Table 8: Dirt Dispersion Test.

S.No	Formulation	Observation	Inference
1.	F1	Dirt present in water layer	Good
2.	F2	Dirt present in water layer	Good
3.	F3	Dirt present in water layer	Good
4.	F4	Dirt present in water layer	Good
5.	F5	Dirt present in water layer	Good
6.	Standard	Dirt present in water layer	Good

The dirt dispersion test showed that in all formulations (F1–F5) and the standard shampoo, the dirt was retained in the water layer, indicating effective cleansing action and minimal deposition of dirt on the foam. This suggests that all polyherbal shampoo formulations exhibit good cleansing ability comparable to the marketed standard.

Antimicrobial Study

Formulated shampoo was studied for its antimicrobial activity against bacterial strain such as ***Staphylococcus aureus.*** In vitro antimicrobial activity performed by agar well diffusion method.

Table 9: Antimicrobial activity (against bacterial strain) of formulated shampoo by Agar well diffusion method.

S.No.	Formulation	Organisms used	Standard	Zone of Inhibition (ZOI) in mm		
			Ciprofloxacin (200 µl/well (std)) ZOI in mm	100 µl/well	200 µl/well	300 µg/well
1.	F1	***Staphylococcus aureus***	18.2	9.3	11.4	13.1
2.	F2		19.0	8.4	11.5	13.3
3.	F3		18.1	10.3	12.2	13.2
4.	F4		21.2	10.4	12.4	13.4
5.	F5		20.0	10.5	11.6	13.5
6.	Standard		18.0	10.4	11.3	13.1

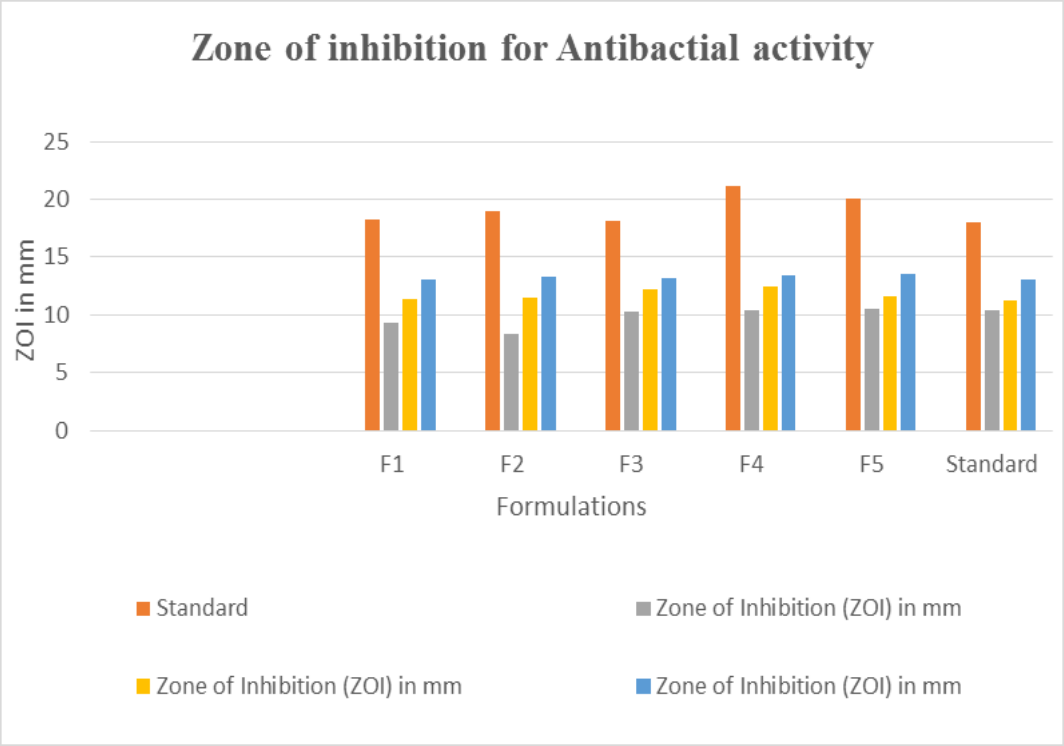

Fig. 2: Zone of inhibition for Antibacterial activity.

All formulations (F1–F5) showed significant antibacterial activity against *Staphylococcus aureus* in a dose-dependent manner. Among them, F4 and F5 exhibited the highest zones of inhibition, comparable to the standard ciprofloxacin at higher concentrations, indicating strong antimicrobial potential. F1, F2, and F3 also showed good activity but with slightly lower inhibition zones. Overall, the results confirm that the polyherbal formulations, particularly F4 and F5, possess promising antibacterial properties.

Stability test

Table 10: Evaluation of Formulation for physical appearance.

S.No	Formulation	1 month	2 months	3 months
1.	F1	No change was observed	No change was observed	No change was observed
2.	F2	No change was observed	No change was observed	No change was observed
3.	F3	No change was observed	No change was observed	No change was observed
4.	F4	No change was observed	No change was observed	No change was observed
5.	F5	No change was observed	No change was observed	No change was observed
6.	Standard	No change was observed	No change was observed	No change was observed

Table 11: Determination of pH.

S.No	Formulation	1 month	2 months	3 months
1.	F1	6.4	6.4	6.5
2.	F2	5.8	6.0	5.9
3.	F3	5.4	6.9	6.7
4.	F4	5.5	5.6	5.7
5.	F5	5.4	5.4	5.4
6.	Standard	5.1	5.3	5.2

Table 12: Foam hight and Foam stability.

S.No.	Formulation	1 month		2 months		3 months	
		Initial Foam Height (cm)	Foam Height after 5min (cm)	Initial Foam Height (cm)	Foam Height after 5min (cm)	Initial Foam Height (cm)	Foam Height after 5min (cm)
1.	F1	7.8	7.8	8	8	7.6	7.6
2.	F2	6.5	6.4	6.0	6.2	6.2	6.0
3.	F3	8.5	8.5	8.4	8.4	8.2	8.2
4.	F4	7.6	7.2	7.5	7.2	7.2	7.0
5.	F5	6.9	5.0	6.8	6.1	6.7	6.2
6.	Standard	7.0	6.5	6.6	6.4	6.8	6.6

Stability testing is a critical parameter to ensure the safety, efficacy, and quality of cosmetic formulations during storage. The polyherbal shampoo formulations were evaluated for stability over a period of three months under defined conditions by monitoring key parameters such as foam characteristics, pH, and physical appearance. Throughout the study, no visible changes were observed in the physical appearance of the formulations, indicating that the product retained its homogeneity and did not show any signs of phase separation, precipitation, or discoloration.

Similarly, the pH values of the formulations remained within the acceptable range for shampoos (5.5–6.5), suggesting that the formulations were chemically stable and would be safe and non-irritant to the scalp and hair during use. Foam stability and foam height also remained unchanged, which demonstrates that the surfactant system and herbal constituents retained their functional properties without degradation.

Overall, the absence of any significant changes in physical, chemical, or functional parameters confirms that the polyherbal shampoo formulations are stable for at least three months. This stability supports their suitability for further development and potential commercial application.

CONCLUSION

The formulated polyherbal hair tonic shampoos demonstrated acceptable physicochemical characteristics, stable pH, and viscosities within the ideal range for herbal shampoos. Foam stability and solid content values confirmed their cleansing ability and consumer appeal. Antimicrobial studies revealed dose-dependent activity against *Staphylococcus aureus*, with F4 and F5 showing superior efficacy. Stability studies further validated the long-term consistency of the formulations, with F1 and F4 being the most stable overall. Thus, the developed polyherbal shampoos, particularly F4, can be considered safe, effective, and promising natural alternatives to synthetic shampoos for scalp and hair care.

BIBLIOGRAPHY

1. Bhowmik D, Kumar KS, Tripathi P, Chiranjib B. Traditional herbal medicines: An overview. Arc. Apl. Sci. Res., 2009; 1(2): 165-177.
2. Manisha S, Swati D, Manisha C, Sonia S. Preparation and evaluation of polyherbal shampoo powder. Int. J. Pharm. Biol. Sci., 2013; 3(1): 151-159.
3. Panigrahi dr, asane gs, khan dm. The textbook of cosmetic sciences. Jec publication.
4. Preethi PJ, Padmini K, Srikanth J, Lohita M, Swetha KP, Rao PV. A review on herbal shampoo and its evaluation. Asian J. Pharm. Ana, 2013; 3(4): 153-156.
5. J. Azmir et al, Techniques for extraction of bioactive compounds from plant materials: A review. JFoodeng, 2013; 117(1): 426–436.
6. Vijayalakshami A, Sngeetha S, Ranjith N. Formulation and evaluation of herbal shampoo. AJPCR, 2018; 11(4): 121-124.
7. Patel S, Gupta A, Gupta M. Formulation and evaluation of polyherbal anti-dandruff shampoo and its marketed comparison. IJRASB., 2022; 1(2): 01-09.
8. Shraddha A. Meshram and Surendra Pardh. Review on formulation and evaluation of herbal shampoo. Wjbphs, 2025; 21(02): 565-571.
9. Kumar A, Dubey A, Singh R. Investigation on anti-ulcer activity of *Momordica dioica* fruits in wistar rats. IJRASB., 2022; 9(1): 105-111.
10. EI-Mohmood AM, Ogbonna OB, Raji M. The antibacterial activity of *Azadirachta indica*-Neem associated with eye and ear infections. J. Med. Plant Res., 2010; 4(14): 1414-1421.
11. G Kaur, Kriplani P, Dhingra A, Chopra B, Deswal G. Formulation and evaluation of anti-dandruff polyherbal powder shampoo. Int. J. Pharm. Qual. Assur, 2016; 2(1): 115-121.
12. Vaou N, Stavropoulou E, Voidarou C, Tsigalou C, Bezirtzoglou E. Towards advances in medicinal plant antimicrobial activity: A review study on challenges and future perspectives. Microorganisms, 2021; 9(10): 2041.
13. Rao KV, Karthik L, Elumalai EK, Srinivasan K, Kumar G. Antibacterial and antifungal activity of

Euphorbia hirta l. Leaves: A comparative study. J Pharm Res., 2010; 3(3): 548.
14. Dandekar VR, Garhwani YD, More A, Pote P, Kore P. Formulation and evaluation of polyherbal anti-dandruff shampoo. IJAM., 2022; 13(2): 365-369.