INTERNATIONAL JOURNAL OF
Clinical and Pharmaceutical Innovations
An International Peer Reviewed Open Access Journal

Research Article

ISSN (Online): 3142-8665
CODEN (USA): IJCPSM

2026, Volume 1, Issue 5, Page No: 223-234.

FORMULATION AND EVALUATION OF HERBAL SUNSCREEN USING TULSI (*OCIMUM SANCTUM*) AND DURVA (*CYNODON DACTYLON*)

***[1]Tejasvi Gawas, [2]Abhishek Gore, [3]Sneha Hundalekar, [4]Sagar Gavali, [5]Aditya Godase, [6]Simran Gawade, [7]Dr. Manoj Kadam**

Shree Saraswati Institute of Pharmacy, Tondavali, Kankavli, Maharashtra, India 416602.

Article Info: **Received:** 29 June 2026, **Revised:** 19 July 2026, **Accepted:** 09 August 2026

***Corresponding Author: Tejasvi Gawas**

Shree Saraswati Institute of Pharmacy, Tondavali, Kankavli, Maharashtra, India 416602.

DOI: https://doi.org/10.5281/zenodo.21893131

Citation:
*[1]Tejasvi Gawas, [2]Abhishek Gore, [3]Sneha Hundalekar, [4]Sagar Gavali, [5]Aditya Godase, [6]Simran Gawade, [7]Dr. Manoj Kadam. (2026). Formulation and Evaluation Of Herbal Sunscreen Using Tulsi (*Ocimum Sanctum*) And Durva (*Cynodon Dactylon*). International Journal of Clinical and Pharmaceutical Innovations, 1(5), 223-234.

ABSTRACT

The present study focuses on the formulation and evaluation of a herbal sunscreen using extracts of Tulsi (*Ocimum sanctum*) and Durva (*Cynodon dactylon*). Exposure to ultraviolet (UV) radiation is a major cause of skin damage, including sunburn, premature aging, and risk of skin cancer. Herbal sunscreens have gained importance due to their safety, biocompatibility, and reduced side effects compared to synthetic agents.In this study, Tulsi and Durva extracts were incorporated into a suitable cream base to develop a natural sunscreen formulation. Both plants are rich in phytoconstituents such as flavonoids, phenolic compounds, and antioxidants, which contribute to UV protection and free radical scavenging activity. The prepared formulation was evaluated for various parameters including organoleptic properties, pH, spreadability, viscosity, stability, Sun Protection Factor (SPF), and antioxidant activity using the DPPH method. The results showed that the formulation possessed good physical characteristics, was stable, non-irritant, and exhibited moderate SPF value along with significant antioxidant activity. The study concludes that the herbal sunscreen formulated with Tulsi and Durva extracts is effective, safe, and suitable for topical application, providing natural protection against harmful UV radiation.

KEYWORDS: Antioxidant, Anti-inflammatory, Antimicrobial, Sustainable, UV protection, Sun Protection Factor.

INTRODUCTION

The skin is the largest organ of the human body and acts as a protective barrier against environmental factors such as ultraviolet (UV) radiation, pollution, and microorganisms. Among these, UV radiation is one of the major causes of skin damage, leading to sunburn, premature aging, pigmentation, and increased risk of skin cancer.

UV radiation is classified into UVA (320–400 nm) and UVB (290–320 nm), both of which penetrate the skin and generate reactive oxygen species (ROS), resulting in oxidative stress and cellular damage. This leads to degradation of skin proteins such as collagen and elastin, causing loss of skin elasticity and formation of wrinkles.

Sunscreens are topical formulations used to protect the skin by absorbing or reflecting harmful UV rays. However, synthetic sunscreens may cause side effects such as skin irritation and allergic reactions, creating a need for safer alternatives.

Herbal sunscreens have gained importance due to their natural origin, safety, and presence of bioactive compounds like flavonoids and phenolics, which provide antioxidant and photoprotective effects. These

compounds help in neutralizing free radicals and reducing UV-induced skin damage.

Tulsi (*Ocimum sanctum*) is known for its antioxidant, anti-inflammatory, and antimicrobial properties due to the presence of compounds like eugenol and flavonoids. Durva (*Cynodon dactylon)* also exhibits antioxidant, soothing, and wound healing properties, making it beneficial for skin protection.

Therefore, the present study focuses on the formulation and evaluation of a herbal sunscreen using Tulsi and Durva extracts as a safe and effective alternative to conventional sunscreens.

- **MATERIAL AND METHODS**

➢ **Materials Required[1]**

Table.01

Sr.No	Ingredients	Role
1.	Herbal: 1) Tulsi Powder 2) Durva Powder	Anti-oxidant, Antimicrobial Anti-inflammatory
2.	Solvents: 1) 70% Ethanol	Solvent
3.	Base: 1) Stearic acid 2) Cetyl Alcohol 3) Emulsifying wax 4) Olive oil 5) Glycerin 6) Methyl paraben 7) Propyl paraben 8) Lavender Oil 9) Distille water	 Thickening agent Emollient Emulsifying agent Emollient Humectant Preservatives Preservatives Fragrance Vehicle

➢ **Preparation of plant extracts Tulsi and Durva**

Fig. 01: (Tulsi and Durva Extract)

▪ **Extraction by using Maceration Process: (Tulsi)[3]**

The dried Tulsi powder (10 g) was extracted by the maceration method using 100 mL of 70% ethanol. The mixture was kept in an airtight container for 48–72 hours with occasional shaking. It was then filtered through Whatman filter paper, and the filtrate was concentrated on a water bath to obtain a semi-solid extract. The prepared extract was stored at 4°C until further use.

- **Extraction by using Maceration Process: (Durva)[4]**

Fresh Cynodon dactylon was washed thoroughly, shade-dried, and powdered. About 10 g of the powdered material was extracted with 100 mL of 70% ethanol by the maceration method for 24–72 hours with occasional shaking. The extract was filtered and concentrated on a water bath to obtain a semi-solid extract, which was stored at 4°C until further use.

- **PHYTOCHEMICAL SCREENING**

Preliminary phytochemical screening of Tulsi and Durva extracts was carried out using standard qualitative methods to identify various phytoconstituents.

- **PHYTOCHEMICAL SCREENING OF TULSI**

Table 02

Sr. No	Phytochemical Constituents	Test performed	Observation	Inference
1	Flavonoids[4] (Eugenol)	Ferric Chloride Test	Formation of Blue or black colour Or greenish black colour	Present of Eugenol (Flavonoids)

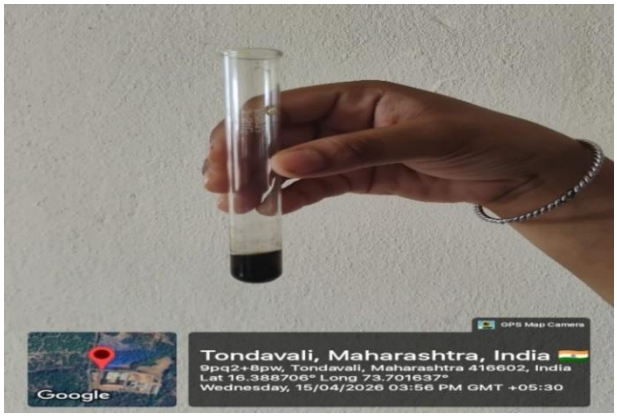


Fig. 02

Table 03

Sr. No	Phytochemical Constituents	Test performed	Observation	Inference
2	Saponins[5]	Foam test	Persistent forth about1-2 cm hight remain for a long time	Present of Saponins

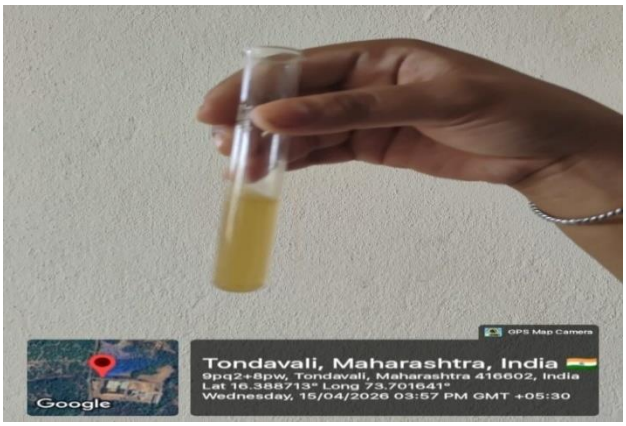


Fig.03

Table 04

Sr. No	Phytochemical Constituents	Test performed	Observation	Inference
3	Flavonoids[6]	Alkali reagent test	The yellow colour appears with NaOH and Disappear with acid	Present of Flavonids

Fig.04

Table 05

Sr. No	Phytochemical Constituents	Test performed	Observation	Inference
4	Tannins[7]	Ferric Chloride Test	Formation of Blue or black colour Or greenish black colour	Present of Tannins

Fig.05

Table 06

Sr. No.	Phytochemical Constituents	Test performed	Observation	Inference
5	Terpenoids[8]	Salkowski test	Formation of reddish-brown coloration at interface	Present of Terpenoids

Fig. 06

- **PHYTOCHEMICAL SCREENING OF TULSI TEST**

Fig.07

(Ferric Chloride Test, Foam, Alkali Reagent Test, Ferric Chloride Test, Salkowski Test)

- **PHYTOCHEMICAL SCREENING OF DURVA**

Table 07

Sr. no	Phytochemical constituents	Test	Observation	Inference
1.	Alkaloids[9]	Alkaline reagent test	Formation of yellow colour at adding NaoHAfter adding dil.HCL colourless	Presentof Alkaloids

Fig.08

Table 08

Sr. no	Phytochemical constituents	Test	Observation	Inference
2.	Phenolic compound[10]	Ferric chloride test	Formation of blue, black, green colour.	Present of phenolic compound

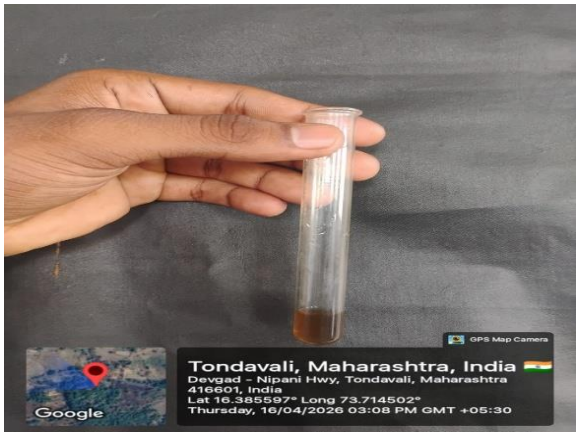


Fig.09

Table 09

Sr.no	Phytochemical constituents	Test	Observation	Inference
3.	Tannins	Lead acetate test[11]	Formation of white precipitate	Present of Tannins

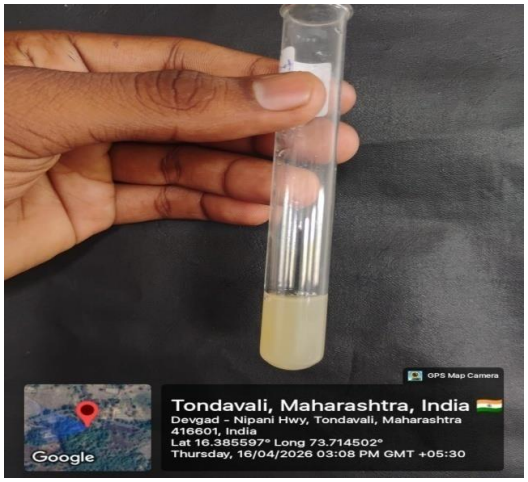


Fig.10

Table 10

Sr.no	Phytochemical constituents	Test	Observation	Inference
4.	Saponins[12]	Foam test	Formation of stable foam	Present of Sapponins

Fig. 11

Table 11

Sr. no	Phytochemical constituents	Test	Observation	Inference
5.	Alkaloids[12]	Dragandroff's Test	Formation of orange or reddish ppt	Present of Alkaloids

Fig.12

- **PHYTOCHEMICAL SCREENING OF DURVA**

Fig. 13

(Alkali Reagent Test, Ferric Chloride test, Lead Acetate Test, Foam Test, Dragandroff Test)

- **METHODOLOGY**

➢ **FORMULATION OF HERBAL SUNSCREEN[13]**

Table 12

Sr. No	Ingredients	Quantity
1.	Herbal: 3) Tulsi Powder 4) Durva Powder	 10g 10g
2.	Solvents: 2) 70% Ethanol	 200 ml
3.	Base: 10) Stearic acid 11) Cetyl Alcohol 12) Emulsifying wax 13) Olive oil 14) Glycerin 15) Methyl paraben 16) Propyl paraben 17) Lavender Oil 18) Distilled water	 3g 1.5g 3g 15ml 3ml 0.015g 0.075g 4-5 drops q.s (30ml)

➢ **Preparation of Oil Phase**

Required ingredients such as olive oil (emollient with mild UV protection), cetyl alcohol, stearic acid, and emulsifying wax are accurately weighed and transferred into a clean beaker. The mixture is heated to about 70 °C with continuous stirring until all components melt completely and form a uniform oily phase.[14]

➢ **Preparation of Aqueous Phase**

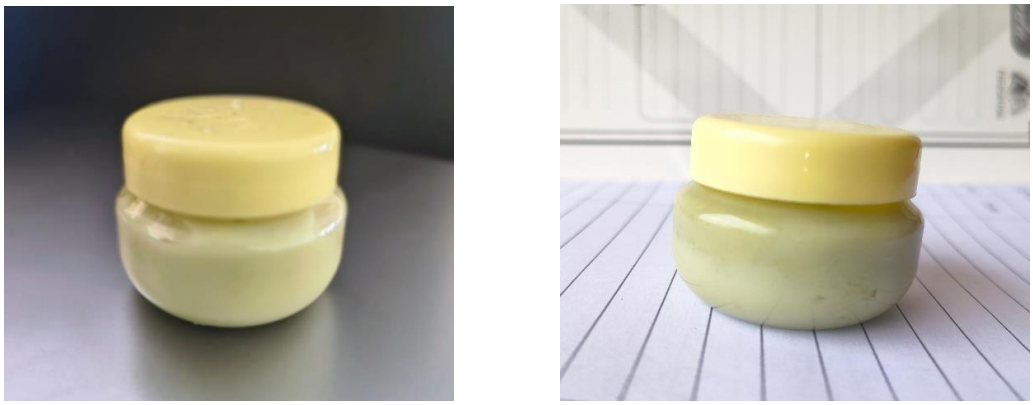
In another beaker, distilled water is taken and mixed with glycerin (humectant) and parabens (preservatives). This mixture is also heated to 70 °C with constant stirring to ensure complete dissolution and to match the temperature of the oil phase.[14]

- **Emulsification**

The aqueous phase is slowly added to the oil phase with continuous stirring. Proper mixing is maintained to form a stable oil-in-water (o/w) emulsion. The mixture is then allowed to cool gradually while stirring continuously until the temperature reaches about 40°C, ensuring uniform consistency and preventing phase separation. They are mixed thoroughly to ensure uniform dispersion throughout the cream, enhancing sunscreen and antimicrobial properties.[14]

- **Final Processing and Packaging**

Optional ingredients such as fragrance or herbal extracts may be added at lower temperatures if required. The final cream is mixed well to obtain a smooth texture and then transferred into sterile containers. The containers are sealed, labelled, and stored in a cool, dry place away from direct sunlight.[14]



Batch no. 1 **Batch no. 2**

Fig no. 14

- **EVALUATION OF HERBAL SUNSCREEN**

Test 1: Organoleptic Evaluation[15,22]

Observation: Colour: light green
Odour: Pleasant herbal
Texture: Smooth & Homogeneous
Grittiness: No Grittiness Observe

Test 2: pH Determination[16]

Take 1 g cream in a beaker. Add 10 mL distilled water and mix well. Calibrate the pH meter. Dip electrode in the sample. Note the pH after stable reading. (pH 5.5-7.0)

Observation: pH 5.79

Fig no. 15

Test 3: Sun Protection Factor Determination[17,23]

Weigh 0.5 g cream and dissolve in ethanol in a 100 mL volumetric flask. Make up volume with ethanol and filter the solution. Take 5 mL stock solution and dilute to 50 mL with ethanol. Use ethanol as blank in UV- Visible Spectrophotometer. Measure absorbance at 290–320nm at 5 nm intervals using UV-Visible Spectrophotometer. Calculate SPF value using.

Mansur equation: $SPF = CF \times \sum EE(\lambda) \times I(\lambda) \times Abs(\lambda)$

Where, CF = Correction Factor (10)
EE(λ) = Erythema effect spectrum
I(λ) = Intensity Spectrum
Abs(λ) = Absorbance of sample at respective wavelength

Observation of Absorbance value

Fig no. 16

Table. 13

Wavelength (nm)	EE × I value	Absorbance
290	0.0150	0.214
295	0.0817	0.398
300	0.2874	0.865
305	0.3278	1.126
310	0.1864	1.084
315	0.0839	0.742
320	0.0180	0.436

SPF Calculation: Total, SPF = 10 × (0.9259)
Final SPF Value is 11.82
Observation: The SPF of the formulated herbal sunscreen was found to be 11.82.

Test 4: Spreadability[20]
Place 1 g cream between two glass slides. Keep a weight on the upper slide for 5 minutes. Tie a thread with small weight to upper slide. Allow the slide to move and note the time taken to travel a fixed distance.

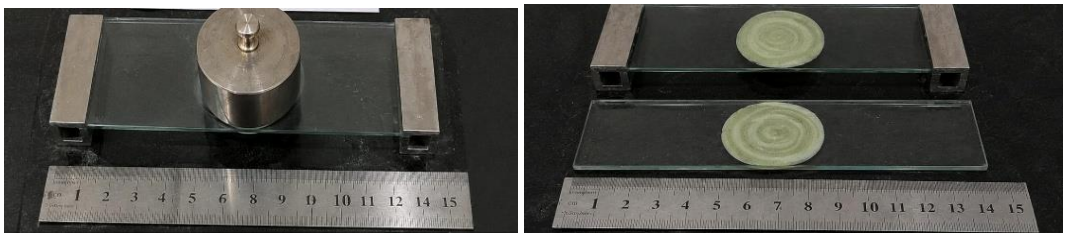


Fig no. 17 (Spreadability test Setup)

Formula: S = M × L/ T
Where, S = Spreadability
M = Weight tied to upper slide (g)
L = Length moved by glass slide (cm)
T = Time taken (sec)
S = 100 × 7.5 / 200
= 3.75 g cm / sec

Observation: Good Spreadability

Test 5: Viscosity Test[18,20]
Herbal sunscreen cream in a beaker. Dip spindle of Brookfield viscometer into the sample. Run the instrument Take at suitable rpm. Note the viscosity reading displayed.

Table. 14

Sr. No	Spindle	RPM	Viscosity
1.	3	12	10817mPa.s

Fig no. 18

Observation: The viscosity of the Herbal Sunscreen was found to be 10817 mPa.s

Test 6: Washability Test[19,24]

Apply a small quantity of the herbal sunscreen formulation on the skin or glass surface. Allow it to remain for a few minutes. Wash the applied area with normal tap water. Observe whether the formulation is easily removed from the surface.

Before
(Sunscreen applied on the skin)

After
(Sunscreen Applied area washing with water)

Fig no. 19

Observation: The formulation was easily washable with water and did not leave excessive oily residue on the surface.

- **RESULT**

➢ **Preliminary Phytochemicals Screening of Tulsi and Durva extracts**

Table 15

Phytochemical Test	Tulsi	Durva
Alkaloids	Present	Present
Flavonoids	Present	Present
Tannins	Present	Present
Phenolic compounds	Present	Present
Saponins	Present	Present
Glycosides	Present	Present
Terpenoids	Present	Present

➢ **Evaluation of Herbal Sunscreen Formulation**

Table 16

Parameter	Specification	Observation
Colour	Light green	Light green
Odour	Characteristic	Characteristic
Appearance	Smooth and homogeneous	Smooth and homogeneous
pH	5.5–7.0	6.8
Spreadability	Easily Spreadable	Good
Viscosity	Smooth consistency	10817 cP
Washability	Easily washable	Good
Skin irritation	No irritation	No irritation
SPF	≥10 (Moderate protection)	11.82

- **DISCUSSION**

The present study was aimed at the formulation and evaluation of a herbal sunscreen using Tulsi and Durva extracts. Herbal sunscreen formulations are gaining importance because natural ingredients possess antioxidant and photoprotective activities with comparatively fewer side effects than synthetic sunscreens. Tulsi and Durva were selected due to their traditional medicinal importance and beneficial effects on skin protection.

The prepared formulation showed good homogeneity and smooth texture, indicating proper mixing and uniform distribution of ingredients within the formulation base. Absence of phase separation suggested successful preparation of the semisolid formulation. These characteristics are important for obtaining a stable and aesthetically acceptable topical preparation.

The pH of the formulation was found within the acceptable range for skin application. Maintaining appropriate pH is important because formulations with unsuitable pH may produce skin irritation and discomfort. The obtained pH indicated that the formulation may be safe for external use.

Viscosity is an important parameter that influences consistency, appearance, and ease of application of

topical formulations. The viscosity obtained in the study indicated that the formulation possesses suitable consistency for topical use. Proper viscosity helps the formulation remain on the skin surface for an adequate period after application.

Spreadability is a significant evaluation parameter for sunscreen formulations because efficient spreading ensures uniform film formation over the skin surface. The formulation showed good spreadability, indicating ease of application and proper distribution on the skin. Uniform spreading is essential for achieving effective photo protective action.

The washability test showed that the formulation can be easily removed from the skin surface with water. Good washability improves patient convenience and acceptability of topical formulations.

Phytochemical screening confirmed the presence of flavonoids, phenolic compounds, tannins, and saponins in Tulsi and Durva extracts. These phytoconstituents are well known for their antioxidant properties and free radical scavenging activities. Ultraviolet radiation generates reactive oxygen species and free radicals which can damage skin cells and accelerate skin aging. Antioxidant constituents present in the herbal extracts may help in neutralizing these harmful free radicals and protecting the skin from oxidative damage.

The SPF value obtained in the present study indicated moderate sunscreen activity of the formulation. The photo protective activity may be attributed to the presence of flavonoids and phenolic compounds in the extracts, which can absorb or reduce the harmful effects of UV radiation. The obtained results suggested that incorporation of Tulsi and Durva extracts contributed effectively to the sunscreen activity of the formulation.

Overall, the findings of the study demonstrated that the prepared herbal sunscreen formulation possesses satisfactory pharmaceutical and cosmetic properties and can be considered suitable for natural skin protection against harmful ultraviolet radiation.

- **CONCLUSION**

The present study concluded that the herbal sunscreen formulation prepared using Tulsi (Ocimum Sanctum) and Durva (Cynodon Dactylon) extracts exhibited promising photoprotective and antioxidant properties due to the presence of flavonoids, phenolic compounds, and other bioactive phytochemicals. The formulation showed satisfactory physicochemical characteristics such as suitable pH, viscosity, spreadability, and washability for topical application. The obtained SPF value indicated moderate protection against harmful ultraviolet radiation. Overall, the study suggests that Tulsi and Durva can be effectively utilized in herbal sunscreen formulations as natural, safe, eco-friendly, and cost-effective alternatives for protecting the skin from UV-induced damage and oxidative stress.

- **REFERENCE**

1. P. Chandini, Naga subrahmanyam S, and Suvarna Jyothi Navuduri. Formulation and evaluation of herbal sunscreen cream. International Journal of Indigenous Herbs and Drugs, 2025; 10(3): 34-38.
2. Toppo, R., & Shrivastava, S. Polyherbal Sunscreen Cream: Formulation, Physicochemical Evaluation, and In Vitro SPF Determination. International Journal of Pharmacognosy and Herbal Drug Technology.
3. Singh V, Singh A, Singh IP, Kumar BD. Phytomedicinal properties of Cynodon dactylon (L.) Pers. (durva) in its traditional preparation and extracts.
4. da Silva FFM, Monte FJQ, de Lemos TLG, do Nascimento PGG, Costa AKM, de Paiva LMM. Eugenol derivatives: synthesis, characterization, and evaluation of antibacterial and antioxidant activities.
5. Liao Y, Li Z, Qing Z, Sheng M, et al. Saponin surfactants used in drug delivery systems: A new application for natural medicine components. International Journal of Pharmaceutics, 2021.
6. Papoutsis K, Zhang J, Bowyer MC, Brunton N, Gibney ER, Lyng J. Fruit, vegetables, and mushrooms for the preparation of extracts with α-amylase and α-glucosidase inhibition properties: A review. Food Chemistry, 2021.
7. Govindarajan RK, Revathi S, Rameshkumar N, Krishnan M, Kayalvizhi N. Microbial tannase: Current perspectives and biotechnological advances. Biocatalysis and Agricultural Biotechnology, 2016.
8. Ludwiczuk A, Skalicka-Woźniak K, Georgiev MI. Terpenoids. In: Badal S, Delgoda R, editors. Pharmacognosy: Fundamentals, Applications and Strategies. London: Academic Press, 2017.
9. Kebede T, Gadisa E, Tufa A. Antimicrobial activities evaluation and phytochemical screening of some selected medicinal plants: A possible alternative in the treatment of multidrug-resistant microbes. PLOS ONE, 2021.
10. Bandara N, Chalamaiah M. Bioactives from agricultural processing by-products. In: Encyclopedia of Food Chemistry. Elsevier, 2019.
11. Arifuzzaman S, Labu ZK, Ani BD, Karim S, Rahman MT. Methanolic crude extract of Litsea monopetala leaves combats oxidative stress, clot formation, inflammation and stool frequency in animal model. PLOS ONE, 2025.
12. Wansi JD, Devkota KP, Tshikalange E, Kuete V. Alkaloids from the medicinal plants of Africa. In: Kuete V, editor. Medicinal Plant Research in Africa: Pharmacology and Chemistry. Oxford: Elsevier, 2013.
13. Shah Y, Mewada R. Preparation and evaluation of herbal sunscreen creams. International Journal of Pharmaceutical Chemistry and Analysis, 2023.

14. Chandini P, Naga Subrahmanyam S, Navuduri SJ. Formulation and evaluation of herbal sunscreen cream. International Journal of Indigenous Herbs and Drugs, 2025; 10(3): 34-38.
15. Shah Y, Mewada R. Preparation and evaluation of herbal sunscreen creams. International Journal of Pharmaceutical Chemistry and Analysis, 2023; 10(2): 116-124. doi:10.18231/j.ijpca.2023
16. Chandini P, Naga Subrahmanyam S, Navuduri SJ. Formulation and evaluation of herbal sunscreen cream. International Journal of Indigenous Herbs and Drugs, 2025; 10(3): 34-38.
17. Pandey P, Sharma A, Sharma H, Vyas GK, Sharma M. Novel researched herbal sunscreen cream SPF determination by in-vitro model. Asian Journal of Pharmaceutical Research and Development, 202.
18. Shah Y, Mewada R. Preparation and evaluation of herbal sunscreen creams. International Journal of Pharmaceutical Chemistry and Analysis, 2023; 10(2): 116-124. doi:10.18231/j.ijpca.2023
19. Tiwari R, Singh I, Gupta M, Singh LP, Tiwari G. Formulation and evaluation of herbal sunscreens: An assessment towards skin protection from ultraviolet radiation. Pharmacophore, 2022.
20. Toppo, M., & Shrivastava, S. (2025). Polyherbal sunscreen cream: Formulation, physicochemical evaluation, and in vitro SPF determination. International Journal of Pharmacognosy and Herbal Drug Technology, 2(8): 1–13.
21. Osterwalder U, Herzog B. Sun protection factors: worldwide confusion. Br J Dermatol, 2009; 161 Suppl 3: 13-24. doi:10.1111/j.1365-2133.2009.09506.x
22. Arora S, Sharma N, Mahajan A, Kaur J, Singh S. Development, physicochemical characterization and in-vitro evaluation of herbal sunscreen lotion. Journal of Pharmaceutical Technology Research and Management, 2015; 3(2): 113-126.
23. Reddy VS, et al. Formulation and evaluation of sunscreen cream. Asian Journal of Pharmaceutics, 2025; 19(4).
24. Sahu MK, Manigauha A, Sahu RK. Preparation and assessment of sunscreen cream containing extract acquired from plant origin. J Pharm Sci Emerg Drugs, 2019; 7(1). doi:10.4172/2380-9477.1000132

