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A Research on Formulation and Evaluation of a Stable Herbal Gel Containing Calendula Officinalis Extract for Topical Application.

Ajay Singh, Mrs. Richa Agnihotri, Dr. Abhishek Soni, Dr. Chinu Kumari

Abstract

The present research work was carried out to formulate and evaluate an herbal topical gel prepared from the flower extract of Calendula officinalis commonly known as marigold. Calendula officinalis has been traditionally used for the treatment of wounds, skin irritation, inflammation, and minor infections due to the presence of various bioactive constituents such as flavonoids, carotenoids, phenolic compounds, and saponins. The study focused on preparing a stable and skin-friendly herbal gel using Carbopol 940 as the gelling agent.

Fresh marigold flowers were collected, shade dried, powdered, and extracted using 70% ethanol by maceration method. The concentrated extract obtained was incorporated into the gel formulation containing propylene glycol, methyl paraben, propyl paraben, triethanolamine, and distilled water. The prepared gel was evaluated for different physicochemical parameters such as pH, Spreadability , homogeneity, and viscosity. The formulation showed a pH of 6.5, which is suitable for topical application and compatible with skin pH. The gel exhibited good Spreadability , smooth texture, satisfactory viscosity, and excellent homogeneity without any lumps or grittiness.

The findings of the study indicate that the formulated marigold herbal gel possesses acceptable physical characteristics and can be considered a promising herbal preparation for topical use. The formulation may provide soothing, moisturizing, and wound healing effects and could serve as a safe and effective alternative to synthetic topical preparations.

1. Introduction:

Flower extracts from Calendula officinalis (pot marigold) have a long history in ethnopharmacology. Its lipophilic and aqueous alcoholic extracts are now authorized by the European Medicines Agency (EMA) as conventional medical preparations for the treatment of mild skin irritation and to help heal small wounds.[1] The benefits of using Calendula officinal flower extract topically and orally on rats' excision wounds were examined. The percentage of wound closure and the number of days required for re-epithelization were the criteria evaluated.[2] Calendula officinalis, a member of the family Asteraceae and kingdom Plantae, is a well-known medicinal herb that has been used for millennia. Other names for it include butterwort, bull flower, Bride of the Sun, English marigold, and pot marigold. Calendula officinalis is often cultivated in a range of soil types and sunny locations.

Calendula officinalis is a tall plant with upright, sparsely branched stems, rectangular lance leaves with tubular disc florets, and curved, yellow, or orange thorns. Both in vitro and in vivo applications are made of carotenoids, flavonoids, saponins, sterols, phenolic acids, lipids, and other biologically active substances present in many plant parts, including leaves and flowers.[3] CO is an annual, self-seeding plant species that thrives in warm, humid environments and reaches a height of 12 to 18 inches. The plant's stalk supports a composite flower head that is 5 to 7 cm in size. The flower head is composed of yellow-orange tubular florets on the inside and an epicalyx of many tapering lanceolate sepals that are compactly covered on both sides by glandular hairs. CO powder is a yellowish-brown powder that tastes slightly bitter and has a strong fragrance. It has normocytic stomata in the apical part of the outer epidermis, pieces of the corolla, covering and glandular trichomes, elongated sclerenchymatous cells, pieces of the ovarian walls with brown pigment, pollen grains, stigma, and fibrous fragments.[4] Reduced ulcer surface area in comparison to controls was shown in two clinical control investigations on venous ulcers. In a similar vein, burn healing produced inconsistent outcomes. The injection of calendula extract before burn injury was shown to have a preventive effect in two animal trials.[5] The plant is well-known as marigold and wonder-of-gardens. Calendula originated in the Mediterranean Sea region, and it is now grown all over the world, including in Brazil. Because of the plant's high saponin content and the gums' and mucilages' potent wetting properties, calendula is used cosmetically in moisturizing lotions for both pre- and post-sun exposure.[6]

Figure 1: *Calendula Officinalis.*

Taxonomical Classification:

Kingdom	*Plantae*
Sub kingdom	*Tracheobionta*
Super division	*Spermatophyta*
Division	*Magnoliophyta*
Class	*Magnoliopsida*
Order	*Asterales*
Family	*Asteraceae*
Genus	*Calendula*
Species	*Calendula officinalis*

Table 1: *Taxonomical classification.*[7,8]

Morphological Characters:

Habbit	Annual herb, erect, branched, aromatic
Root	Taproot system, moderately branched
Stem	Soft, herbaceous, angular, hairy (pubescent), light green
Leaves	Simple, alternate, sessile (no petiole), oblong to lanceolate, margins entire or slightly toothed, hairy surface
Flower	Bright yellow to orange; two types: ray florets (female, ligulate) and disc florets (bisexual, tubular)
Cylax	Modified into pappus (reduced or absent)
Fruit	Achene
Seed	Non-endospermic
Colour	Leaves: green; Flowers: yellow to deep orange
Odor	Characteristic, slightly aromatic

Table 2: *Morphological Classification.*[9,10]

Pharmacological Properties:

Calendula Officinalis offers a wide variety of pharmacological properties for with various phytoconstituents. Some of the pharmacological properties are:

Wound Healing:

In ethnopharmacology, floral extracts from Calendula officinalis (pot marigold) have a long history. Its lipophilic and aqueous alcoholic extracts are now authorized by the European Medicines Agency (EMA) as conventional medical preparations for the treatment of mild skin irritation and to help heal small wounds.[11] The perennial Mediterranean plant Calendula officinalis is widely used as an anti-inflammatory and for wound healing.[12]

Anti Inflammatory:

Calendula extracts have a long history of safety and are used in many cosmetics and preparations, particularly for damaged and irritated skin. However, nothing is known about how calendula extracts reduce inflammation. Thus, the capacity of a commercial calendula flower extract to prevent LPS-exposed RAW 264.7 macrophages from producing NO. The findings demonstrated a safety profile and dose-dependent NO inhibition up to 50%, supporting the calendula flower extract's anti-inflammatory properties.[13]

Anti-Bacterial:

Gram positive bacteria like Bacillus subtilis and Staphylococcus aureus as well as Gram negative bacteria like Escherichia coli and Pseudomonas aeruginosa were stopped from growing in vitro by the flowers' essential oil; these findings are consistent with some earlier research. When the zone of inhibition is larger than 6 mm, antibacterial activity is noted.[14]

Anti-tumour activity:

When evaluated on a range of human and murine tumor cell lines, the LACE extract demonstrated a strong in vitro suppression of tumor cell growth. The range of inhibition was 70–100%. Caspase-3-induced apoptosis and cell cycle arrest in the G0/G1 phase were shown to be the mechanisms of inhibition. It's interesting to note that when the same extract was tested on PBLs and NKL cell lines, it had the opposite effect, causing these cells to proliferate and become activated in vitro.[15]

Anti-oxidant activity:

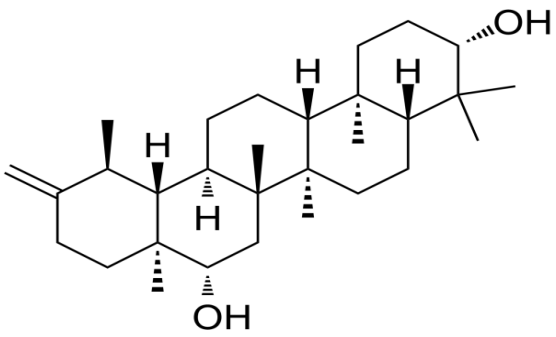
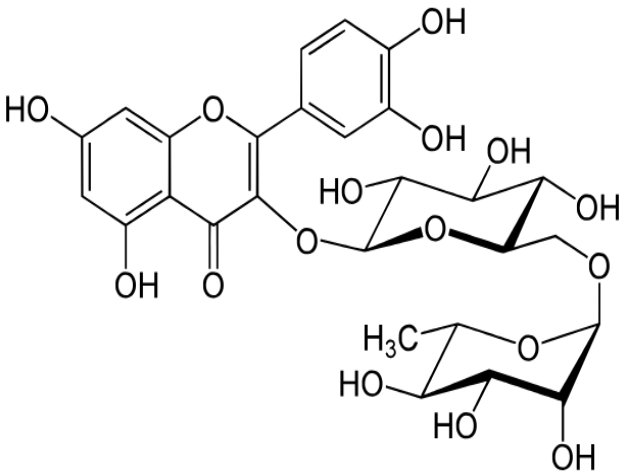
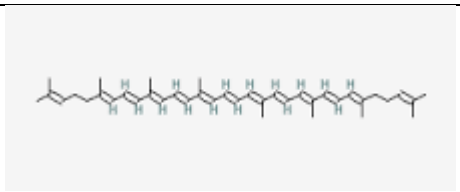
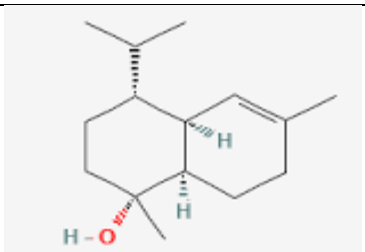
Calendula officinalis extract. The antioxidant capacity of Linn. (Compositae) was assessed in vitro. and Calendula officinalis in vivo. It was discovered that the extract inhibited and scavenged hydroxyl radicals produced by the Fenton reaction and superoxide radicals produced by photoreduction of riboflavin in vitro. peroxidation of lipids. 500, 480, and 2000 µg/mL were the concentrations required for 50% inhibition (IC50). The IC50 values for extract scavenging ABTS and DPPH radicals were 6.5 and 100 µg/mL, respectively. Ginger extract, a common antioxidant extract, was used to compare the IC50 values.[16]

Anti-aging activity:

Cream compositions reported antiaging benefits may result from the coordinated action of many ingredients. Phenolic acids and flavonoids are among the many botanicals that seem to be beneficial against UV radiation-induced damage; nevertheless, evidence-based research on their antiaging properties is still lacking. In the future, a cautious evaluation of their clinical effectiveness should be carried out since the environment influences the skin-cream interaction.[17]

Phytochemical Screening:

Hundreds of physiologically active components, including carotenoids, flavonoids, saponins, sterols, phenolic acids, lipids, amino acids, carbohydrates, etc., are present in complex mixes found in natural goods that include calendula extract or oil.[18]

Chemical Structure	Part of Plant.
Arnidiol	
	Flower.
Rutin	
	Flower, Leaves.
Lycopene	
	Petals.
T-muurolol	
	Flower
Oleanolic acid glycosides	

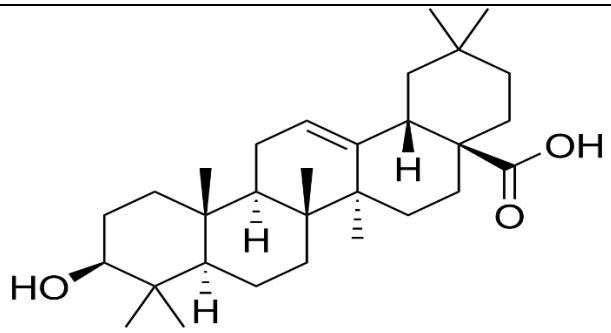
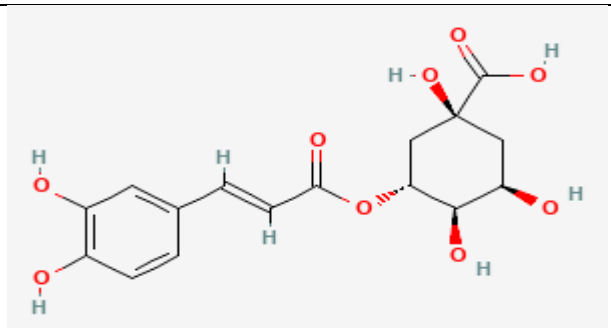
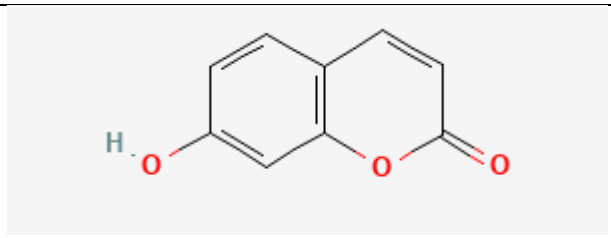
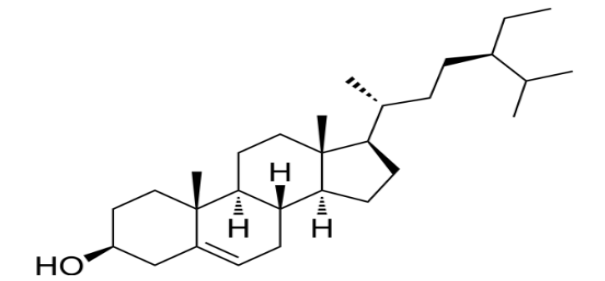
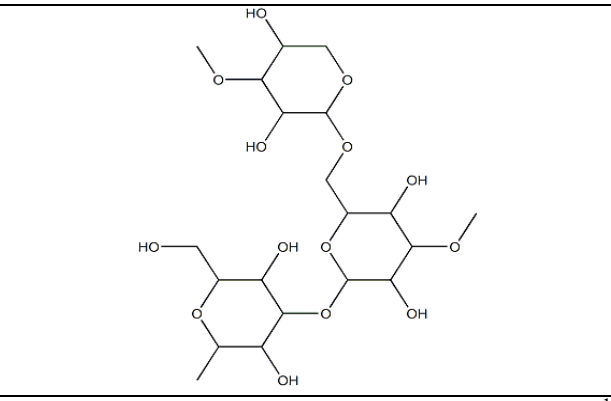
	Roots, Flower
Chlorogenic acid	
	Leaves, Flower
Umbelliferone	
	Whole Plant
β-sitosterol	
	Leaves, Flower
Arabinogalactans	
	Flower

Table 3: *Phytochemical Screening.*[19,20,21,22]

Aim and Objective:

Aim:

To formulate and evaluate a stable topical herbal gel containing 15 ml of concentrated marigold (Calendula officinalis) extract.

Objectives:

- Standardize extraction of marigold flowers.
- Optimize the gelling agent concentration.
- Evaluate physicochemical parameters.
- Assess the stability of the final gel.

Plan of Work:

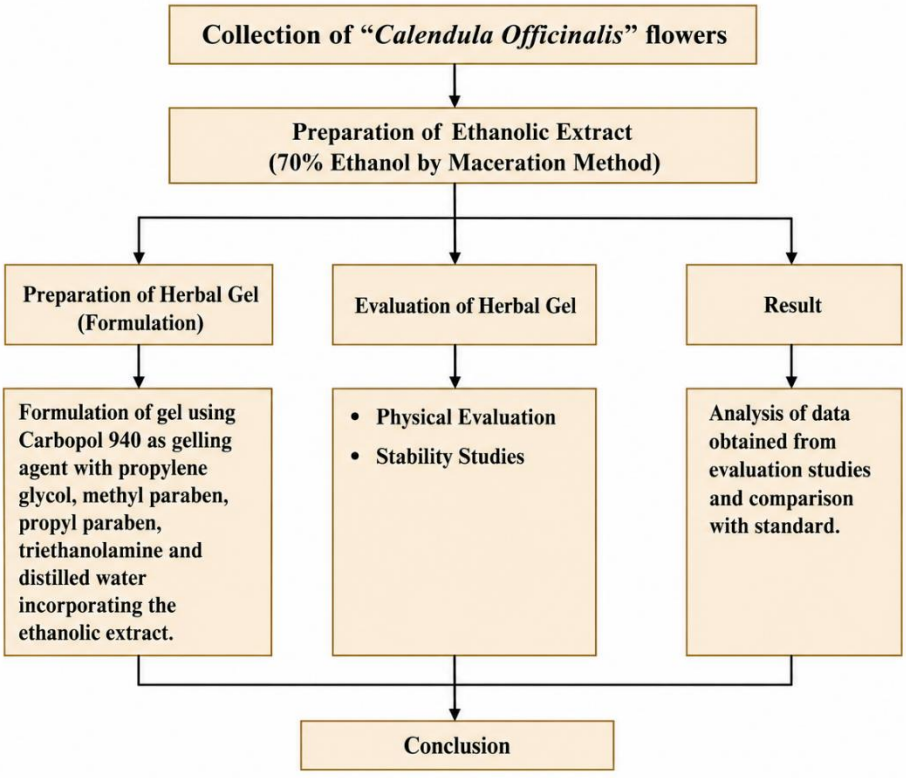


Figure 2: *Plan of work.*

Material and Methodology:

Collection:

Fresh flowers of Calendula Officinalis were collected from Lunapani, Balh, Mandi, Himachal Pradesh, India on 11 March, 2026.

Drying:

The collected flowers were washed with water and shade dried at room temperature until a constant weight was observed.

Size Reduction:

The dried plant material was reduced to a coarse form using manual mortar pestle.[23]

Figure 3: *Size Reduction.*

Method of Extraction:

1. The powder is accurately weighed and transferred to a conical flask for extraction.
2. Add 70% ethanol as solvent.
3. Maintain 1:10 of plant material to solvent.

Figure 4: *Extraction Process.*

4. Close/ seal the flask and keep it at room temperature for 48-72 hours.

5. Shake the mixture occasionally to improve the extraction.
6. After the extraction, filter the mixture using whatman filter paper.

Figure 5: *Filtration Process.*

7. Evaporate the solvent using water bath at 40-50 degree Celsius until a thick concentrated extract is obtained.[24]

Figure 6: *Obtained Extract.*

Preparation of marigold herbal gel:
Ingredients and Quantity:

Sr. No.	*Ingredient*	*Quantity*
1.	Marigold Flower Extract	5g
2.	Carbopol 940	1g
3.	Propylene Glycol	10ml
4.	Methyl Paraben	0.2g
5.	Propyl Paraben	0.02g
6.	Triethanolamine	q.s. (0.5-1)
7.	Distilled Water	q.s. to 100ml

Procedure:

1. **Preparation of Gel Base:**

a. Take 1g of Carbopol 940 in a clean beaker.
b. Add about 40-50 ml of distilled water slowly with continuous stirring.
c. Allow it to hydrate and swell for 30-60 minutes until a clear dispersion is formed.

2. **Preparation of preservative solution:**

a. Dissolve 0.2gm of methyl paraben and add 0.02gm of propyl paraben in 10ml propylene glycol.
b. Heat slightly (about 50 degree Celsius) if required to dissolve completely.

3. Addition of herbal extract:

a. Take 5gm of concentrated marigold extract of Calendula Officinalis.
b. Dissolve or disperse the extract in a small quantity of distilled water or propylene glycol.
c. Mix thoroughly to form a uniform solution.

4. Mixing:

a. Add the preservative solution to the Carbopol dispersion with continuous stirring.
b. Then add the marigold extract solution slowly while stirring to obtain a uniform mixture.

Figure 7: Mixing.

5. Neutralization and gel formation:

a. Add triethanolamine dropwise to the mixture.
b. Continuous stirring will convert the liquid dispersion into a clear gel.
c. Adjust the pH to about 6-7, suitable for skin application.

6. Final volume adjustment:

a. Add distilled water to make the final weight 100g.
b. Stir slowly to remove air bubbles.

Figure 8: *Final volume adjustment.*

7. **Packaging:**

a. Transfer the prepared gel into clean, dry, airtight container or collapsible tubes.

b. Store at room temperature away from direct sunlight.

Figure 9: *Packaging of herbal gel.*

Evaluation parameters:

- **pH measurement:**
  The pH of the formulated herbal gel was found to be approximately 6.5 using universal pH paper, indicating that the formulation is suitable for topical application and compatible with skin pH.

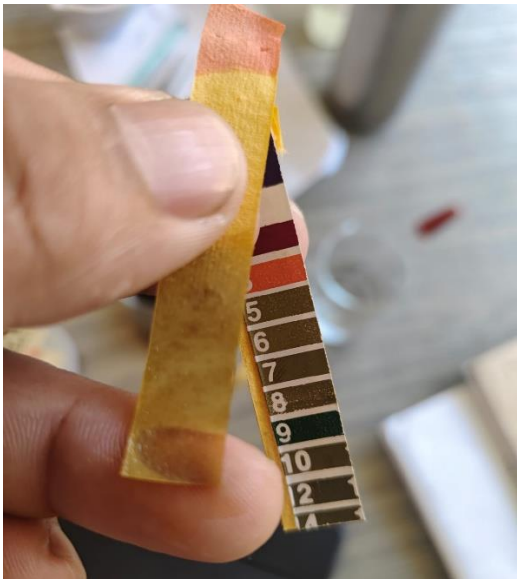


Figure 10*: pH measurement.*

- **Spreadability:**
  The prepared herbal gel exhibited good spreadability with a value of 6.7 g cm/sec, indicating smooth application and uniform spreading on the skin surface.
- **Homogeneity:**
  The formulated herbal gel showed good homogeneity with a smooth and uniform appearance without any lumps or grittiness.
- **Viscosity:**
  The formulated herbal gel showed a viscosity of 4876 cps, indicating good consistency and satisfactory application properties.

Conclusion:

The present research work successfully focused on the formulation and evaluation of a herbal topical gel containing extract of Calendula officinalis (marigold), a medicinal plant well known for its therapeutic and skin healing properties. The prepared gel formulation was found to possess satisfactory physicochemical characteristics such as suitable pH, good spreadability, acceptable viscosity, smooth texture, and excellent homogeneity, indicating that the formulation is stable, aesthetically appealing, and suitable for topical administration. The pH of the gel was found to be compatible with the normal skin pH, suggesting reduced chances of irritation and better patient compliance during application.

Calendula officinalis contains several important phytoconstituents including flavonoids, carotenoids, triterpenoids, phenolic compounds, and saponins, which contribute to its wound healing, anti-inflammatory, antioxidant, antimicrobial, and soothing activities. Incorporation of the concentrated marigold extract into the gel base may therefore enhance the therapeutic potential of the formulation and support faster healing of minor wounds, cuts, burns, and skin irritation while also providing moisturizing and protective effects on the skin.

The study also demonstrates the importance of herbal formulations in modern pharmaceutical and cosmetic preparations. Compared to synthetic products, herbal gels are generally considered safer, economical, biocompatible, and associated with fewer side effects. The prepared marigold herbal gel showed good consistency, ease of application, and overall stability, which makes it a promising candidate for topical herbal therapy and skincare applications.

Overall, the findings of the study suggest that the formulated herbal gel can serve as an effective and patient-friendly topical preparation with potential medicinal and cosmetic benefits. Further studies involving microbial evaluation, accelerated stability studies, skin irritation testing, and clinical investigations may help to establish its efficacy, safety, and commercial applicability on a larger scale.

References:

1. Nicolaus, C., Junghanns, S., Hartmann, A., Murillo, R., Ganzera, M., & Merfort, I. (2017). In vitro studies to evaluate the wound healing properties of Calendula officinalis extracts. *Journal of ethnopharmacology*, *196*, 94-103.
2. Preethi, K. C., & Kuttan, R. (2009). Wound healing activity of flower extract of Calendula offlcinalis. *Journal of basic and clinical physiology and pharmacology*, *20*(1), 73-80.
3. Patil, K., Sanjay, C. J., DoggALLI, N., Devi, K. R., & Harshitha, N. (2022). A Review of Calendula Officinalis-Magic in Science. *Journal of Clinical & Diagnostic Research*, *16*(2).
4. Shahane, K., Kshirsagar, M., Tambe, S., Jain, D., Rout, S., Ferreira, M. K. M., ... & Lima, R. R. (2023). An updated review on the multifaceted therapeutic potential of Calendula officinalis L. *Pharmaceuticals*, *16*(4), 611.
5. Givol, O., Kornhaber, R., Visentin, D., Cleary, M., Haik, J., & Harats, M. (2019). A systematic review of Calendula officinalis extract for wound healing. *Wound repair and regeneration*, *27*(5), 548-561.
6. Ullah, M. A., Hassan, A., & Hamza, A. (2023). Calendula (Calendula officinalis) marigold as medicinal plant. *Orthopaedics Case Rep*, *2*(1), 1-9.
7. U.S. Department of Agriculture, Natural Resources Conservation Service. (n.d.). *Calendula officinalis* L. Retrieved April 27, 2026, from https://plants.usda.gov
8. Sharma, P. C., Yelne, M. B., & Dennis, T. J. (2005). *Database on medicinal plants used in Ayurveda* (Vol. 3). Central Council for Research in Ayurveda and Siddha.
9. Kokate, C. K., Purohit, A. P., & Gokhale, S. B. (2010). *Pharmacognosy* (46th ed.). Nirali Prakashan.
10. Trease, G. E., & Evans, W. C. (2009). *Trease and Evans pharmacognosy* (16th ed.). Saunders Elsevier.
11. Nicolaus, C., Junghanns, S., Hartmann, A., Murillo, R., Ganzera, M., & Merfort, I. (2017). In vitro studies to evaluate the wound healing properties of Calendula officinalis extracts. *Journal of ethnopharmacology*, *196*, 94-103.
12. Parente, L. M. L., Lino Junior, R. D. S., Tresvenzol, L. M. F., Vinaud, M. C., de Paula, J. R., & Paulo, N. M. (2012). Wound healing and anti-inflammatory effect in animal models of Calendula officinalis L. growing in Brazil. *Evidence-Based Complementary and Alternative Medicine*, *2012*(1), 375671.

13. Silva, D., Ferreira, M. S., Sousa-Lobo, J. M., Cruz, M. T., & Almeida, I. F. (2021). Anti-inflammatory activity of Calendula officinalis L. flower extract. *Cosmetics*, *8*(2), 31.
14. Hamad, M. N., Mohammed, H. J., & Merdaw, M. A. (2017). Antibacterial activity of Calendula officinalis flowers in vitro. *Ibn AL-Haitham Journal For Pure and Applied Science*, *24*(3).
15. Jiménez-Medina, E., Garcia-Lora, A., Paco, L., Algarra, I., Collado, A., & Garrido, F. (2006). A new extract of the plant Calendula officinalis produces a dual in vitro effect: cytotoxic anti-tumor activity and lymphocyte activation. *BMC câncer*, *6*(1), 119.
16. Preethi, K. C., Kuttan, G., & Kuttan, R. (2006). Antioxidant Potential of an Extract of Calendula officinalis. Flowers in Vitro. and in Vivo. *Pharmaceutical biology*, *44*(9), 691-697.
17. Jadoon, S., Karim, S., Asad, M. H. H. B., Akram, M. R., Kalsoom Khan, A., Malik, A., ... & Murtaza, G. (2015). Anti-aging potential of phytoextract loaded-pharmaceutical creams for human skin cell longetivity. *Oxidative medicine and cellular longevity*, *2015*(1), 709628.
18. Verma, P. K., Raina, R., Agarwal, S., & Kour, H. (2018). Phytochemical ingredients and Pharmacological potential of Calendula officinalis Linn. *Pharmaceutical and Biomedical Research*.
19. Della Loggia, R., Tubaro, A., Sosa, S., Becker, H., Saar, S., & Isaac, O. (1994). The role of triterpenoids in the topical anti-inflammatory activity of Calendula officinalis flowers. Planta Medica, 60(6), 516–520.
20. Khalid, K. A., & Teixeira da Silva, J. A. (2012). Biology of Calendula officinalis Linn.: Focus on pharmacology, biological activities and agronomic practices. Medicinal and Aromatic Plant Science and Biotechnology, 6(1), 12–27.
21. Preethi, K. C., Kuttan, G., & Kuttan, R. (2009). Anti-inflammatory activity of flower extract of Calendula officinalis Linn. and its possible mechanism of action. *Indian Journal of Experimental Biology, 47*(2), 113–120.
22. Trease, G. E., & Evans, W. C. (2009). Trease and Evans pharmacognosy (16th ed.). Saunders Elsevier.
23. Ansari, M. H., Jain, A., Kanere, M., & Singhai, A. K. (2024). Formulation and evaluation of microemulsion-based gel of *Calendula officinalis* extract and its antimicrobial activity. *International Journal of Multidisciplinary Research and Studies*.
24. Kaur, R., Rathore, C., Barik, B. B., Samanta, A., Rahamanulla, A., et al. (2025). Development and characterization of *Calendula officinalis* extract-loaded topical gels for inflammatory skin conditions. *Journal of Neonatal Surgery*.
25. Archi, D., Pooja, K., & Shital, F. (2024). Formulation and evaluation of *Calendula* and lavender oil based topical antifungal gel. *Journal of Pharmaceutical Research International*.
26. Singh, B., Chopade, N., Sawant, R., Katkar, S., & Ghorge, P. (2025). Formulation and evaluation of herbal gel containing *Calendula officinalis* and Aloe vera for topical application. *International Journal of Creative Research Thoughts*.
27. Singh, M., & Bagewadi, A. (2017). Comparison of effectiveness of *Calendula officinalis* extract gel with lycopene gel for treatment of leukoplakia. *International Journal of Pharmaceutical Investigation, 7*(2), 88–93.
28. Jiménez, R. A., Millán, D., Suesca, E., Sosnik, A., & Fontanilla, M. R. (2015). Controlled release of *Calendula officinalis* flower extract from collagen scaffolds. *Drug Delivery and Translational Research*.

29. Okuma, C. H., et al. (2015). Development of lamellar gel phase emulsion containing marigold oil as a potential wound dressing. *European Journal of Pharmaceutical Sciences*.
30. Harborne, J. B. (1998). *Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis*. Springer.
31. Khandelwal, K. R. (2008). *Practical Pharmacognosy: Techniques and Experiments*. Nirali Prakashan.
32. Allen, L. V., Popovich, N. G., & Ansel, H. C. (2014). *Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems*. Lippincott Williams & Wilkins.
33. Aulton, M. E., & Taylor, K. (2018). *Aulton's Pharmaceutics: The Design and Manufacture of Medicines*. Elsevier.
34. Rangari, V. D. (2012). *Pharmacognosy and Phytochemistry*. Career Publications.
35. harma, P. P. (2010). *Cosmetics: Formulation, Manufacturing and Quality Control*. Vandana Publications.