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FORMULATION AND EVALUATION OF HERBAL LOTION USING LEAVES OF *TRIDAX PROCUMBENS LINN*

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ABSTRACT

Herbal topical formulations have gained renewed research interest owing to their inherent biocompatibility, lower adverse-effect profile, and multi-constituent synergistic activity. Among medicinal plants, Tridax procumbens Linn. (family Asteraceae) occupies a prominent place in traditional ethnopharmacology, with documented antimicrobial, anti-inflammatory, antioxidant, and wound-healing activities attributed to its rich phytochemical profile, which encompasses flavonoids, alkaloids, tannins, saponins, terpenoids, and phenolic acids. The present investigation was undertaken to develop and characterize a stable oil-in-water herbal lotion incorporating a hydroalcoholic leaf extract of T. procumbens. The formulation was designed using pharmaceutical-grade excipients—including Carbopol 940, cetostearyl alcohol, emulsifying wax, liquid paraffin, glycerine, camphor, and standard preservatives—to obtain an elegant, nongreasy, skin-compatible topical preparation. Phytochemical screening confirmed the presence of all major secondary metabolites. Physicochemical evaluation encompassed appearance, pH, viscosity, spreadability, homogeneity, washability, and accelerated stability under varied temperature conditions. Antimicrobial efficacy was determined by the agar well-diffusion method against Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, and Candida albicans. Results demonstrated that the optimized lotion exhibited a smooth, homogeneous texture (pH 6.2 ± 0.1), acceptable viscosity (3,800–4,200 cP), and satisfactory spreadability (12.4 ± 0.8 $g \cdot cm \cdot s^{-1}$). No phase separation, colour change, or skin irritation was observed during a 90-day stability study. The formulation produced notable zones of inhibition against all tested organisms (8–18 mm), indicating clinically relevant antimicrobial activity. These findings support the potential of T. procumbensbased herbal lotion as a safe and effective topical agent for wound care and dermatological management.

KEYWORDS: Tridax procumbens, herbal lotion, oil-in-water emulsion, phytochemical screening, wound healing, antimicrobial activity, topical formulation.

1. INTRODUCTION

Skin constitutes the largest organ of the human body and serves as the primary defence barrier against mechanical trauma, microbial invasion, chemical insults, and ultraviolet radiation. Disruption of this barrier—through wounds, burns, or infections—necessitates therapeutic intervention that restores structural integrity and prevents pathogen colonisation. While synthetic topical agents remain widely used, growing concerns regarding chemical sensitisation, antimicrobial resistance, and long-term toxicity have rekindled interest in plant-derived formulations.[1,2]

Tridax procumbens Linn., commonly referred to as coat buttons or tridax daisy, is a herbaceous annual belonging to the tribe Heliantheae of the family Asteraceae. Distributed extensively across tropical and subtropical regions of Asia, Africa, and the Americas, the plant has been recorded in diverse traditional medicine systems—including Ayurveda, Unani, and African ethnobotany—as a remedy for haemostasis, wound healing, skin infections, and inflammatory dermatoses.[3,4] Pharmacological investigations have corroborated several of these traditional claims, identifying key bioactive constituents such as quercetin, luteolin, apigenin, lupeol, beta-amyrin, and caffeic acid as responsible for observed anti-inflammatory, antioxidant, and antimicrobial effects.[5]

Lotions, classified as low-viscosity oil-in-water (o/w) emulsions, are particularly suited to large-area topical application owing to their spreadability, rapid percutaneous absorption, non-occlusive nature, and high patient acceptability.[6]

The o/w system permits incorporation of both hydrophilic and lipophilic active substances while providing a moisturising and cooling effect on application. By combining the bioactive potential of T. procumbens extract with a well-optimised lotion base, it is possible to develop a phytoformulation that simultaneously delivers wound-healing, antimicrobial, and skin-care benefits.

Despite the wealth of pharmacological data available on T. procumbens, documentation of rigorous lotion formulation studies is limited in the literature. The present work was therefore designed to:

(i) Prepare and characterise a hydroalcoholic leaf extract;
(ii) Develop a stable o/w herbal lotion;
(iii) Conduct comprehensive physicochemical evaluation; and
(iv) Assess antimicrobial efficacy — thereby providing a scientifically validated platform for further pre-clinical and clinical investigation of this medicinally valuable plant.

1.2. PLANT PROFILE AND PPHYTOCHEMISTRY

2.1 Taxonomic Classification

S. No.	Parameter	Description
1	Scientific Name	Tridax procumbens Linn.
2	Common Name	Coat buttons, Tridax daisy, Mexican daisy
3	Family	Asteraceae
4	Kingdom	Plantae
5	Division	Angiosperms
6	Class	Dicotyledonae
7	Order	Asterales
8	Genus	Tridax
9	Species	procumbens
10	Phylum	Tracheophyta

1.2 Vernacular Names

Tridax procumbens is recognized by a variety of regional names across the Indian subcontinent and beyond. In Bengali it is called Tridhara or Bishalya karani; Hindi speakers refer to it as Khal muriya or Gharma; the Sanskrit designation is Jayanti veda. In Marathi the plant is known as Gaddis chemanthi, while Tamil-speaking communities use the names Vettukayathalai and Thatha, and Telugu speakers identify it as Gayapuaku or Palaka aku. Internationally, the plant is most widely recognized by its English common names — coat buttons, tridax daisy, and Mexican daisy.

1.3 Botanical Description

Tridax procumbens grows as a ground-hugging to weakly erect herbaceous plant, completing its life cycle as an annual or a short-duration perennial and typically attaining a height of 20–50 cm. The stems are thin, covered with fine hairs, and divide freely into secondary branches. Foliage is arranged in opposite pairs along the stem; individual leaves are ovate to lanceolate in outline, measuring 2–6 cm in length, with a tapering base, pointed tip, and irregularly toothed margins. Each flowering head arises singly on an elongated stalk; the outer ray florets range from white to pale yellow and terminate in three shallow notches, while the inner disc florets are tubular and uniformly yellow. The fruits are small, lightweight achenes bearing a crown of feathery bristles that harness wind currents for dispersal, enabling the species to colonize open, disturbed ground with remarkable efficiency.

1.4 Phytochemical Constituents

The wide-ranging medicinal utility of T. procumbens can be traced to an abundance of biologically active secondary metabolites that occur across its various plant parts:

- Flavonoids (quercetin, luteolin, apigenin, isoquercetin) — principal antioxidant and antiinflammatory agents.
- Alkaloids — contribute to analgesic and antimicrobial effects.
- Tannins — astringent polyphenols that promote haemostasis, tissue contraction, and antibacterial action.
- Saponins — glycosidic surfactants with immunostimulatory and wound-cleansing properties.
- Terpenoids/Triterpenes (lupeol, beta-amyrin) — anti-inflammatory and tissue-regenerative activities.
- Phenolic acids — augment antioxidant defence and inhibit microbial growth.
- Steroids/Phytosterols — modulate inflammatory cascades and support healing.
- Glycosides — contribute to broad therapeutic activities.
- Vitamins (Vitamin C) — support collagen synthesis and skin repair.

2. MATERIALS AND METHODS

2.1 Plant Material Collection and Authentication

Fresh, healthy leaves of T. procumbens were harvested from cultivated plants and authenticated by a qualified botanist.

The leaves were washed under running tap water to remove surface contaminants, followed by a final rinse with distilled water. They were then spread on clean muslinlined trays and shade-dried at ambient temperature (25 ± 2°C) for 7–10 days, avoiding direct sunlight to prevent degradation of heat-sensitive phytoconstituents. The dried leaves were ground using a mechanical grinder to a coarse powder and stored in an airtight container until extraction.

2.2 Preparation of Hydroalcoholic Extract

Sixty grams (60 g) of the powdered plant material were loaded into a Soxhlet extraction apparatus. Hydroalcoholic solvent (ethanol:water, 70:30 v/v) was used as the extracting medium. Extraction was conducted continuously at 60°C for 48 hours. The collected extract was filtered through Whatman No. 1 filter paper, concentrated under reduced pressure using a rotary evaporator, and stored at 4°C until use.

2.3 Phytochemical Screening

The concentrated extract was subjected to standard qualitative tests to detect major secondary metabolite classes:

Phytoconstituent	Test Applied	Observation	Inference
Flavonoids	Shinoda Test (Mg + conc. HCl)	Orange-red colour	Present
Flavonoids	Sulphuric Acid Test	Deep yellow colour	Present
Tannins / Phenolics	5% $FeCl_3$ solution	Blue-black precipitate	Present
Tannins / Phenolics	Lead acetate solution	White precipitate	Present
Carbohydrates	Fehling's Test	Brick-red precipitate	Present
Terpenoids	Salkowski test	Reddish-violet ring	Present
Steroids	Liebermann-Burchard test	Green-blue colour	Present
Glycosides	Keller-Kiliani Test	Brown ring at interface	Present
Proteins	Xanthoprotein Test	Orange/yellow colour	Present

2.4 Formulation of Herbal Lotion

2.4 .1 Composition

Ingredient	Quantity (% w/w)	Function
T. procumbens leaf extract	5–10	Active therapeutic agent
Glycerine	3–5	Humectant and moisturiser
Liquid paraffin	10–15	Emollient; reduces transepidermal water loss
Cetostearyl alcohol	2–4	Emulsion stabiliser and thickener
Emulsifying wax	3–5	Primary emulsifying agent (o/w)
Camphor	0.1–0.5 [4]	Cooling, soothing, mild analgesic
Methyl paraben	0.1–0.2	Antimicrobial preservative
Propyl paraben	0.02–0.05	Antimicrobial preservative
Triethanolamine	q.s.	pH adjustment
Purified water	q.s. to 100	Aqueous continuous phase / vehicle

2.4. 2 Preparation Procedure

Step 1 – Oil Phase Preparation: Cetostearyl alcohol, emulsifying wax, liquid paraffin, propyl paraben, and camphor were weighed accurately and melted together in a stainless-steel beaker by heating on a water bath at 70–75°C until a clear melt was obtained.

Step 2 – Aqueous Phase Preparation: Glycerine, methyl paraben, and purified water were heated separately to the same temperature (70–75°C) with continuous stirring until the paraben was completely dissolved.

Step 3 – Emulsification: The aqueous phase was added to the oil phase with continuous mechanical stirring at moderate speed. Stirring was maintained while allowing the mixture to cool to approximately 40°C.

Step 4 – Incorporation of Extract: The hydroalcoholic T. procumbens extract was added to the partially cooled emulsion base with gentle stirring to ensure uniform distribution.

Step 5 – pH Adjustment and Final Volume: Triethanolamine was added dropwise to adjust the pH to the desired range (6.0–6.5). Purified water was added to make up to the final volume (100 g). The formulation was stirred until a smooth, homogeneous lotion was obtained and then filled into amber glass jars.

2.5 Physicochemical Evaluation Parameters

Appearance and Organoleptic Properties

The lotion was assessed visually for colour, odour, phase separation, and texture. A small quantity was spread on the dorsum of the hand to assess greasiness and spreading characteristics.

pH Measurement

One gram (1 g) of lotion was dispersed in 10 mL of distilled water and the pH was determined using a calibrated digital pH meter at room temperature (25 ± 1°C). The measurement was performed in triplicate.

Viscosity

Viscosity was measured using a Brookfield RVT viscometer with a suitable spindle (No. 5) at 20 rpm and 25°C. Results were expressed in centipoise (cP).

Spreadability

Spreadability was determined using the parallel-plate method. A fixed quantity of lotion was sandwiched between two glass plates under a standard weight (100 g). The length traversed by the upper plate in 30 seconds was recorded. Spreadability (S) was calculated as: $S = M \times L / T$, where M = applied weight (g), L = distance (cm), T = time (s).

Homogeneity

A portion of the lotion was applied between two glass slides and examined visually and by touch for uniformity of texture, absence of grit, and freedom from lumps or phase separation.

Washability

The lotion was applied to the forearm and washed with tap water. The ease of removal and the presence of any oily residue were noted.

Accelerated Stability Study

Lotion samples were stored under three conditions — room temperature (25 ± 2°C / 60% RH), refrigerated (4 ± 2°C), and accelerated conditions (40 ± 2°C / 75% RH) — for 90 days following ICH Q1A(R2) guidelines. Samples were withdrawn at 0, 30, 60, and 90 days and evaluated for colour, odour, pH, viscosity, and phase separation.

Skin Irritation Test

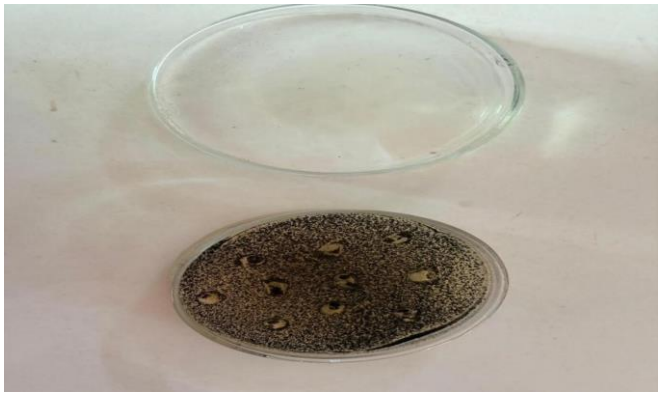
A small amount of lotion was applied to a 2 cm^2 patch on the inner forearm of healthy volunteers (n = 6) and occluded for 24 hours. The site was then observed for erythema, oedema, itching, or other signs of irritation using a standard grading scale (0 = no reaction, 3 = severe reaction).

Antimicrobial Activity

Antimicrobial efficacy was evaluated by the agar well-diffusion method against Staphylococcus aureus (ATCC 25923), Escherichia coli (ATCC 25922), Pseudomonas aeruginosa (ATCC 27853), and Candida albicans (ATCC 10231).

Mueller-Hinton agar was used for bacterial strains and Sabouraud dextrose agar for the fungal strain. Wells (6 mm diameter) were bored in inoculated agar plates, and 100 µL of lotion suspension was introduced into each well.

Standard antibiotic discs (ampicillin for bacteria; fluconazole for fungus) and blank lotion base served as positive and negative controls, respectively. Plates were incubated at 37°C/24 h (bacteria) or 28°C/48 h (fungi). Zones of inhibition were measured in millimetres.



3. RESULTS

3.1 Phytochemical Screening Results

Qualitative phytochemical analysis of the hydroalcoholic leaf extract of T. procumbens confirmed the presence of all major secondary metabolite classes tested, including flavonoids, tannins, phenolic compounds, saponins, terpenoids, steroids, glycosides, carbohydrates, and proteins (Table 2). The rich phytochemical profile provides a mechanistic basis for the observed pharmacological activities of the plant.

3.2 Physicochemical Evaluation

3.2.1 *Organoleptic Properties*

The formulated lotion was creamy white in appearance with a characteristic mild herbal odour attributable to the T. procumbens extract and camphor. The texture was smooth, uniform, and free of visible particles. No greasiness was observed upon application.

3.2.2 *Summary of Physicochemical Parameters*

Parameter	Observation / Value	Acceptable Range / Remark
Colour	Creamy white	Consistent; no discolouration
Odour	Mild herbal	Acceptable; no rancidity
Texture	Smooth, homogeneous	Free of grit and lumps
pH	6.2 ± 0.1	5.5–7.0 (skin-compatible)
Viscosity	4,050 ± 180 cP	3,500–5,000 cP (ideal lotion range)
Spread ability	12.4 ± 0.8 g·cm·s^{-1}	Easy spreading; low rubbing required
Homogeneity	Uniform; no phase separation	Pass
Wash ability	Easily removed with water	No oily residue
Skin Irritation Score	0 (in all volunteers)	No irritation / Pass

3.2.3 *Stability Study Results*

During the 90-day accelerated stability study, samples stored at room temperature and refrigerated conditions remained stable with no significant changes in pH (± 0.2 units), viscosity (< 5% variation), colour, or odour. Samples stored at 40 ± 2°C / 75% RH also retained physical integrity without phase separation, although a marginal viscosity decrease (~4%) was noted at day 90, remaining within acceptable limits. These findings indicate satisfactory thermodynamic stability of the formulation.

3.3 Antimicrobial Activity Results

Test Organism	Zone of Inhibition (mm) — Lotion	Zone of Inhibition (mm) — Positive Control	Inference
Staphylococcus aureus	16 ± 1.2	22 ± 0.8 (ampicillin)	Good activity
Escherichia coli	13 ± 0.9	19 ± 1.0 (ampicillin)	Moderate activity
Pseudomonas aeruginosa	10 ± 1.0	17 ± 1.2 (ampicillin)	Moderate activity
Candida albicans	12 ± 0.7	20 ± 0.9 (fluconazole)	Good antifungal activity

The T. procumbens herbal lotion demonstrated the highest activity against S. aureus (16 ± 1.2 mm), a gram-positive pathogen commonly implicated in wound infections, followed by C. albicans (12 ± 0.7 mm). Moderate inhibition was recorded against the gram-negative organisms E. coli and P. aeruginosa. The blank lotion base showed no zone of inhibition, confirming that the observed activity was attributable exclusively to the T. procumbens extract. These results are consistent with earlier reports of the plant's broad-spectrum antimicrobial activity and substantiate the suitability of the formulation for managing superficial skin and wound infections.

4. DISCUSSION

The present study successfully achieved its objectives of formulating, characterising, and evaluating a herbal lotion based on T. procumbens leaf extract. The o/w emulsion system was selected because it provides a non-greasy, water-miscible base that facilitates rapid absorption and comfortable application over large skin surfaces—features that are particularly relevant for wound-care products.

The pH of the optimised formulation (6.2 ± 0.1) falls within the physiologically compatible range for human skin (5.5–7.0), reducing the risk of skin irritation or disruption of the acid mantle. The viscosity value (4,050 cP) confers the necessary consistency for lotion application without excessive stiffness, ensuring adequate spreadability while preventing run-off from the application site.

The antimicrobial results align with previously published work on T. procumbens extracts. The superior activity against S. aureus may be attributed to the bactericidal action of flavonoids (particularly quercetin and luteolin) on gram-positive cell walls, as well as the tannin-mediated disruption of cytoplasmic membranes.[2,3] Reduced but significant

activity against gram-negative species (E. coli, P. aeruginosa) is consistent with the additional outer-membrane barrier in these organisms.[6]

The accelerated stability data indicate that the lotion base successfully protects the phytoconstituents from degradation under typical storage conditions. The incorporation of methyl and propyl parabens as a dual-preservative system, combined with the antioxidant flavonoid content of the extract itself, likely contributes to enhanced formulation longevity. The absence of skin irritation in all six volunteers confirms the biocompatibility of both the excipient combination and the herbal extract— an important safety attribute for a product intended for repeated topical application. Compared to existing studies on T. procumbens formulations (gels, creams), the lotion format offers distinct patient-compliance advantages: ease of application, rapid drying, and a non-sticky after-feel. The results of the present study therefore provide a strong scientific foundation for further preclinical wound-healing studies in validated animal models and subsequent clinical evaluation.

5. CONCLUSION

This study achieved its primary objective of developing a botanically sourced herbal lotion from the hydroalcoholic extract of Tridax procumbens Linn. Leaves that satisfies the core criteria of formulation science — physical acceptability, chemical durability, and demonstrable biological function.

Screening of the extract for secondary metabolites revealed a rich phytochemical composition encompassing flavonoids, tannins, saponins, terpenoids, steroids, glycosides, and phenolic acids. The co-occurrence of these constituent classes offers a multi-target mechanistic foundation for the wound-healing and antimicrobial actions anticipated from the finished preparation.

Characterization of the lotion's physicochemical attributes returned a pH reading of 6.2 ± 0.1, placing it comfortably within the range tolerated by intact skin. A measured viscosity of 4,050 ± 180 cP conferred adequate body for cutaneous retention without impeding spreadability, while the preparation dispersed uniformly across skin surfaces and was readily cleared with water, collectively reflecting sound formulation design.

When subjected to 90-day accelerated aging under both refrigerated and ambient storage environments, the lotion retained its original color, odor, pH, and textural integrity without detectable phase separation or degradation, a finding that speaks to satisfactory product shelf life.

Evaluation of antimicrobial potency through agar well diffusion yielded clear inhibitory halos measuring 16 mm for Staphylococcus aureus, 13 mm for Escherichia coli, 12 mm for Candida albicans, and 10 mm for Pseudomonas aeruginosa — a pattern of broad-spectrum activity consistent with the known bioactivity of the flavonoid and polyphenol constituents within the extract.

Volunteer patch testing over 24 hours under occlusion produced no observable cutaneous reactions, affirming that the formulation carries a low sensitization risk and is safe for topical use on human skin. Collectively, these results establish T. Procumbens herbal lotion as a scientifically grounded, naturederived topical agent worthy of further development. Recommended next steps include controlled in vivo wound-healing trials, studies on transdermal permeation kinetics, and process scale-up assessments aimed at bridging this laboratory preparation toward clinical and commercial deployment.

REFERENCES

1. Indian Pharmacopoeia; (Not explicitly stated in the excerpt, but it's a publication of) The Delhi Controller of Publications, 1996; vol. 2, Delhi.
2. Ansel's Pharmaceutical Dosage forms and Drug Delivery Systems, Ointments, Creams and Gels; Loyd V. Allen Jr, Howard C. Ansel; 9th Edition, 2011; 323-325.
3. Evaluation of topical formulations of aqueous extract of Centella asiatica on open wounds in rats; Sunilkumar, Parameshwaraiah, S., and Shivakumar, H.G.; Indian Journal of Experimental Biology, 1998; 36: pp. 569-572.
4. Adv Drug Deliv Rev; Langer R.; 2004; 56: 557-558.
5. Pharm Sci Technol; Naik A, Kalia YN, Guy RH.; 2000; 3: 318-326.
6. Pharmacology and Biochemical Evaluation of Tridax procumbence on inflammation; Diwan PV, Karwande I, Margaret I, Sattur PB.; Indian J Pharmocol, 1989; 21: 1-7.
7. "Immunomodulatory effects of aqueous extract of Tridax procumbens in experimental animals"; U. Tiwari, B. Rastogi, P. Singh, D.K. Saraf, S.P. Vyas; Journal of Ethnopharmacology, 2004; 92(1): 113-19.
8. "Pharmacology of Tridax procumbens a weed: review"; S. Mundada, R. Shivhare; International Journal of Pharm Tech Research, 2010; 2(2): 1391-94.
9. "Influence of Tridax procumbens on wound healing"; P.V. Diwan, L.D. Tillo, D. Kulkarni; Indian J. Med Res, 1982; (75): 450-54.
10. "Repellent activity of selected plant essential oils against the malarial fever mosquito, Anopheles stephensi"; Rajkumar, S. And Jebanesan, A.; Tropical Biomedicine, 2007; 24(2): 71-5.