Formulation And Evaluation of an Antimicrobial Wound Healing Ointment Containing Tridax Procumbens leaf Extract

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Abstract

Wound healing is a complex biological process that can be delayed due to microbial infections. The increasing resistance to antibiotics has led to the search for safe and effective herbal alternatives. The present study aims to formulate and evaluate an antimicrobial wound healing ointment containing Tridax procumbens leaf extract, known for its medicinal properties.

The leaves were collected, dried, and extracted using a suitable solvent. The extract was found to contain phytochemicals such as flavonoids and tannins, which promote healing. The ointment was prepared using an appropriate base and evaluated for physicochemical properties including pH, consistency, and spreadability.

Antimicrobial activity was tested against Staphylococcus aureus and Escherichia coli, showing effective inhibition. Wound healing studies indicated faster recovery and reduced healing time.

The results suggest that the formulated ointment is a safe, effective, and economical herbal alternative for wound management.

Key words : Tridax procumbens, Wound healing, Antimicrobial activity, Herbal ointment, Phytochemicals, Topical formulation

Introduction

Wound healing is a natural and complex process by which the body repairs damaged tissues. It involves different stages such as inflammation, tissue formation, and remodeling. However, this process can be delayed due to infections, poor hygiene, and other health conditions. Microbial infection is one of the major factors that slow down wound healing and may lead to serious complications. Therefore, proper wound care and the use of effective antimicrobial agents are very important.

In recent years, the use of synthetic drugs has been associated with side effects and increasing antibiotic resistance. This has created a need for safer and more effective alternatives. Herbal medicines have gained attention because they are natural, easily available, cost-effective, and have fewer side effects.

Tridax procumbens, commonly known as coat buttons, is a medicinal plant widely used in traditional medicine for its wound healing and antimicrobial properties. It contains important phytochemicals such as flavonoids, tannins, and alkaloids, which help in reducing infection and promoting tissue repair.

The present study aims to formulate and evaluate a topical ointment containing Tridax procumbens leaf extract and to study its antimicrobial and wound healing effectiveness.

Types of Wounds:

Wounds can be classified into different types based on their cause and nature:

1. **Open Wounds :-** In these wounds, the skin is broken and exposed.

Examples: cuts, abrasions, lacerations, puncture wounds.

2. **Closed Wounds :-** The skin is not broken, but damage occurs underneath.

Examples: bruises, hematoma.

3. **Acute Wounds :-** These heal quickly with proper treatment.

Examples: surgical wounds, minor cuts.

4. **Chronic Wounds :-** These take a long time to heal due to infection or poor blood supply.

Examples: diabetic ulcers, pressure sores

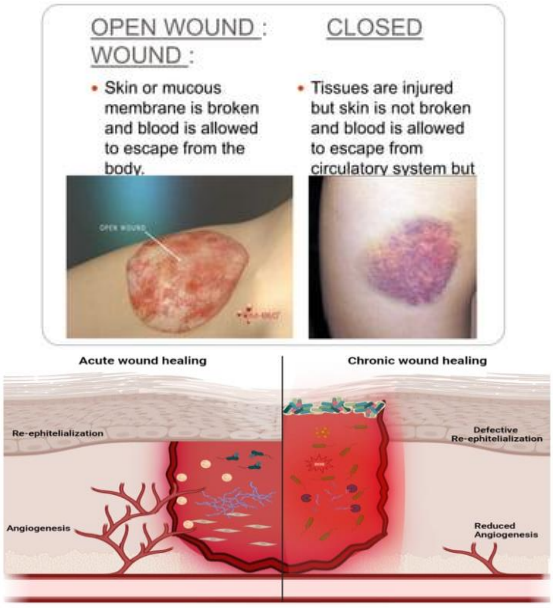

fig.no. 1 Types of wound healing

Mechanism of Wound Healing

Wound healing occurs in four main stages:

1. **Hemostasis(StoppingBleeding):**
   Immediately after injury, blood vessels constrict and clotting occurs to stop bleeding.
2. **Inflammation**
   White blood cells remove bacteria and dead tissue. This stage may cause redness, swelling, and pain.
3. **Proliferation**
   New tissue, blood vessels, and collagen are formed. The wound starts to close during this phase.
4. **Maturation (Remodeling)**

   The wound becomes stronger as collagen is reorganized and the skin regains its normal structure.

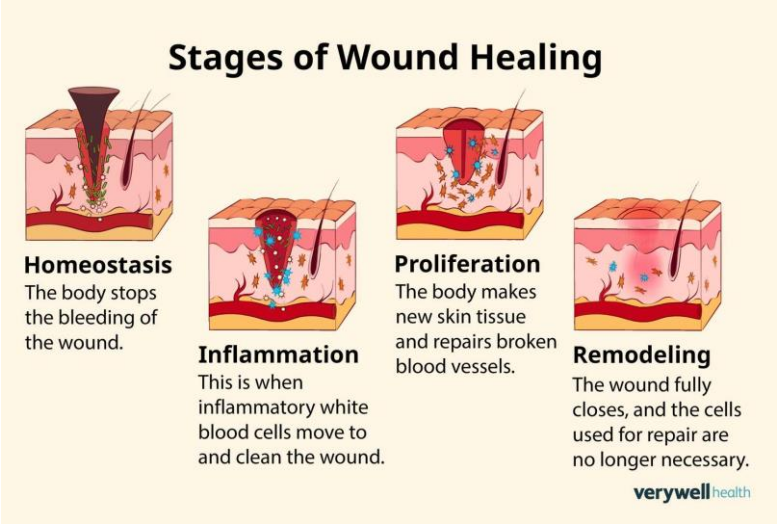

Fig no.2 Mechanism of wound healing

Plant Profile: Tridax procumbens

Figno.3 (Tridax procumbens)

- Botanical Name: Tridax procumbens
- Kingdom: Plantae
- Order: Asterales
- Family: Asteraceae
- Genus: Tridax
- Species: T. procumbens
- Synonym: Dagadipala, Kabarmodi
- **Habit:** Annual or perennial creeping herb
- **Distribution:** Widely found in tropical and subtropical regions of Asia, Africa, and the Americas. Commonly grows along roadsides, wastelands, and open fields.

Morphological Description

- **Stem:** Prostrate, creeping, hairy, and branched.
- **Leaves:** Opposite, simple, lance-shaped with toothed margins, covered with fine hairs.
- **Flowers:** Small, yellow disc-shaped flowers with white ray florets, usually 1–2 cm in diameter.
- **Fruit:** Achene (small, dry, single-seeded fruit) with tiny hairs for wind dispersa

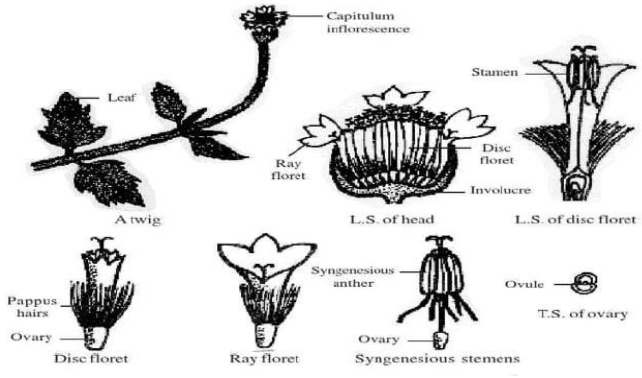

Fig.No.4 Morphology of plant

Phytochemical Constituents

The leaves and aerial parts contain:

- **Flavonoids** – Promote healing and antioxidant activity
- **Tannins** – Antimicrobial and astringent properties
- **Alkaloids** – Anti-inflammatory effects
- **Saponins** – Promote tissue regeneration
- **Essential oils** – Contribute to antimicrobial activity

Pharmacological Activities

- Wound healing
- Antimicrobial and antifungal
- Anti-inflammatory
- Hemostatic (stops bleeding)
- Antioxidant

Traditional Uses

- Applied topically for cuts, wounds, and insect bites
- Used in folklore medicine for skin infections, fever, and inflammation

Aim

To formulate and evaluate an antimicrobial wound healing ointment containing Tridax procumbens leaf extract and assess its physicochemical properties, antimicrobial activity, and wound healing efficacy.

Objectives

1. To collect, authenticate, and prepare Tridax procumbens leaves for extraction.
2. To prepare a solvent extract of the leaves and perform phytochemical screening.
3. To formulate a topical ointment incorporating the leaf extract using a suitable ointment base.
4. To evaluate the ointment for physicochemical properties such as color, odor, consistency, pH, spreadability, extrudability, and stability.
5. To assess the antimicrobial activity of the formulation against common wound pathogens like Staphylococcus aureus and Escherichia coli.
6. To study the wound healing efficacy of the ointment using in vivo wound models.
7. To compare the formulated ointment with standard marketed wound healing formulations.

***Material And Equipment**

Sr.No	Composition	Quantity
1	Beeswax.	5g
2	Cetostearyl alcohol	5g
3	White soft paraffin	85g
4	Wool fat	5g
5	Liquid Paraffin	5ml

Table No. 1 composition of ointment

***Method of preparation:**

#Preparation of Tridax procumbens Leaf Extract

1. Collection and Authentication of Plant Material

-Fresh leaves of Tridax procumbens were collected from a suitable location. The plant material was authenticated by a qualified botanist, and a voucher specimen was preserved for future reference.

2. Preparation of Plant Material:-

-The collected leaves were washed thoroughly with distilled water to remove dirt and contaminants.

-Leaves were shade-dried at room temperature (25–30°C) for 7–10 days to prevent degradation of active constituents.

-The dried leaves were pulverized using a mechanical grinder to obtain a coarse powder.

-The powder was passed through sieve no. 40 to ensure uniform particle size.

3. Extraction by Cold Maceration Process:-

***Materials Required:-**

• Coarsely powdered leaf material

• Solvent (e.g., ethanol, methanol, or hydroalcoholic mixture)

• Conical flask or maceration jar with lid

• Muslin cloth

• Watsman filter paper

#Procedure:-

-A known quantity of powdered leaf material (e.g., 100 g) was placed in a clean, dry maceration container.

-The powder was soaked in a suitable solvent (e.g., 70% ethanol) in a ratio of 1:10 (drug:solvent, i.e., 100 g powder in 1000 mL solvent).

-The container was tightly closed to prevent solvent evaporation.

-The mixture was allowed to stand for 72 hours (3 days) at room temperature.

-The mixture was shaken intermittently (every 6–8 hours) to enhance extraction.

-After 72 hours, the mixture was filtered first through muslin cloth and then through Whatman filter paper.

-The marc (residue) was re-macerated with fresh solvent for another 24 hours to ensure maximum extraction.

-The filtrates were combined.

4. Concentration of Extract:

-The combined filtrate was concentrated using a rotary evaporator or by evaporation on a water bath at a temperature not exceeding 40–50°C.

-The concentrated extract was dried to obtain a semi-solid or solid mass.

-Percentage yield of extract was calculated

5.Preparation of Ointment Base:

***Method of preparation:-**

-All ingredients were weighed accurately.

-Beeswax was melted first on a water bath.

-Remaining ingredients were added in descending order of melting point.

-The mixture was stirred continuously until a uniform base was formed.

-The base was allowed to cool with constant stirring.

6. Incorporation of Extract into Ointment Base:

***Procedure**:

-A required quantity of dried Tridax procumbens extract (e.g., 5% w/w or 10% w/w) was weighed.

-The extract was levigated with a small quantity of the ointment base to form a smooth paste.

-The paste was gradually incorporated into the remaining base with continuous trituration.

-Mixing was continued until a uniform ointment was obtained.

-The final ointment was transferred into sterile, airtight containers

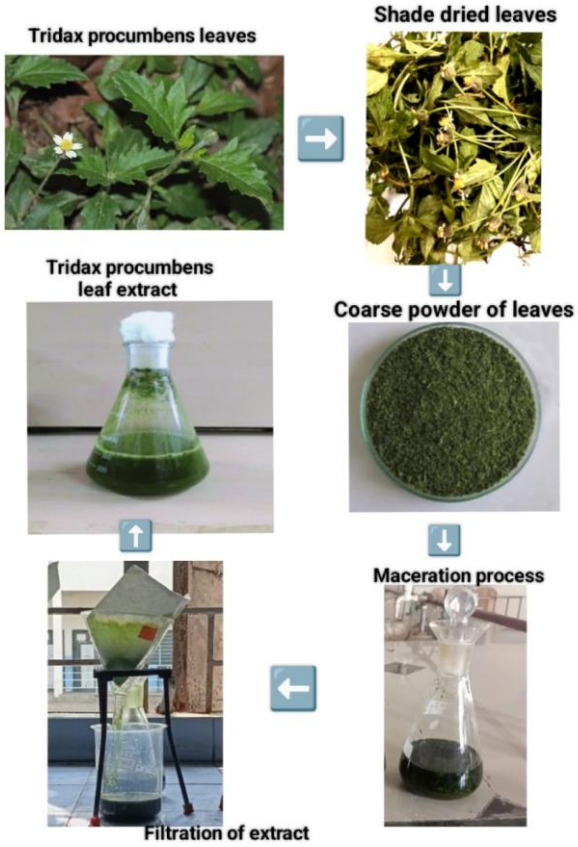

Fig no. 4 Extraction process

Study design for wound healing activity.:

- Excision wound models were used to assess the wand healing profile of leaf. Extract of Tridax procumbens which was formulated in ointment base. The drug treatments were as follows. Six mice were taken for each group.
- Group A: - Received ointment base and served as normal control
- Group B: - Received reference standard Beta dine Ointment (100 mg/gm)
- Group C: - Received Tridax procumbens ointment (80 mg/gm)
- Group D: - Received Tridax procumbens ointment (100 mg/gm)

EVALUATION PARAMETERS:-

1. Organoleptic Evaluation :

Parameters	**Observation**
Color	Light green
Odour	Pleasant herbal
Texture	Smooth, homogenous, free from grittiness
Consistency	Semi solid suitable for topical application
Spreadability	Easily spreadable on skin
Appearance	Uniform, no phase separation

Table no.2 organoleptic evaluation

2.pH Determination:

(Ideal pH Range-5.5-6.5)

Sample	pH value
Herbal ointment	5.76

Table no.3 pH determination

3.Viscosity Measurement:

Sample	Viscosity(cP)
Herbal ointment	14800cP

Table no.4 Viscosity Measurement

4.Spreadability:

(Normal range : 5-7.5 cm)

sample	Spreadability
Herbal ointment	6.8cm

Table no.5 Spreadability

5.Extrudability Test:

Sample	Extrudability
Herbal ointment	Good

Table no.6 Extrudability Test

6.Stability Study:

Parameter	Initial	After 30 days
Color	Light green	No change
Odor	Herbal	No change
pH	5.76	5.70
Appearance	Smooth	Smooth

Table no.7 Stability Study

Fig no.5 Final Product

RESULTS AND DISCUSSION

The ethanol extract of Tridax procumbens leaves was found to contain several important bioactive compounds, including flavonoids, tannins, alkaloids, saponins, and phenols. These phytochemicals are known to promote wound healing through antioxidant, anti-inflammatory, antimicrobial, and collagen-promoting activities. The formulated ointment exhibited excellent physicochemical properties: it had a smooth and uniform consistency, a mild herbal odor, and a skin-compatible pH of 6.5–6.8. The ointment demonstrated good spreadability and extrudability, indicating ease of application. Stability studies revealed no significant changes in color, odor, or texture over a 30-day period, confirming the formulation's suitability for storage. In antimicrobial testing, the ointment showed significant inhibition against Staphylococcus aureus and Escherichia coli, with activity increasing at higher extract concentrations, demonstrating its potential to prevent wound infections. In wound healing studies, the ointment-treated wounds showed faster contraction, reduced epithelialization time, and overall improved healing compared to control, comparable to standard marketed formulations.

CONCLUSION

The study successfully formulated a herbal wound healing ointment using Tridax procumbens leaf extract, which was found to be safe, effective, and stable. The presence of bioactive phytochemicals contributed to both antimicrobial activity and accelerated wound healing. The ointment's favorable physicochemical properties, combined with its ability to promote faster tissue repair and prevent infection, indicate that it is a promising natural alternative to synthetic wound healing products. This study supports the potential use of Tridax procumbens ointment for minor wounds and skin injuries and highlights its suitability for further clinical evaluation and possible commercial development.

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