IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 1, May 2025
Impact Factor: 7.67

# Formulation and Evaluation of Herbal Liniments Using Dhatura Leaves (Datura Stramonium)

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**Abstract:** *Herbal liniments have long been valued for their therapeutic benefits in traditional medicine, offering natural solutions for pain relief, inflammation reduction, and wound healing. this study, an herbal liniment was formulated using the leaves of Datura stramonium, a herb renowned for its analgesic, anti-inflammatory, and antimicrobial activity. Fresh leaves of Datura were collected under safe conditions, shade-dried, and extracted by hydro-alcoholic solvents to extract maximum active constituents. The resultant extract was prepared as a liniment base with the aid of suitable oils and emulsifying agents. The final liniment was checked for significant parameters like appearance, pH, spreadability, viscosity, and stability at varied conditions of storage. Preliminary phytochemical screening identified alkaloids, flavonoids, tannins, and steroids as present, and these compounds are thought to account for the medicinal activity of Datura. The liniment demonstrated encouraging anti-inflammatory and weak analgesic activities in preliminary testing, indicating its potential as an adjunct therapy for muscle aches, sprains, and minor injuries. Efforts were made to detoxify and standardize the extract to reduce any toxic effects of Datura alkaloids. This study highlights the importance of traditional medicinal plants like Datura in modern herbal formulations and provides a scientific foundation for the development of safe, effective, and affordable liniment preparations. Additional clinical assessments and toxicological investigations are suggested to determine the complete therapeutic potential and safety profile of the formulated product.*

**Keywords:** Datura stramonium leaves, Herbal liniment, Anti-inflammatory, Analgesic activity, herbal topical formulation, Pain relief

## I. INTRODUCTION

Herbs have been a valuable source of medicines since ancient times and have played a crucial role as natural therapeutic agents in traditional systems of medicine. Among those, Datura stramonium, known colloquially as Dhatura, is a valuable medicinal plant that is highly recognized for its analgesic, anti-inflammatory, and antimicrobial properties5. The leaves of Datura contain bioactive compounds like alkaloids (atropine, hyoscyamine, and scopolamine), flavonoids, and tannins, which are responsible for its strong pharmacological activities3.

Topical use of herbal preparations has seen resurgence over the past few decades as safer drugs compared to synthetic ones. Liniments, which consist of liquid or semi-liquid external preparations to be rubbed onto the skin, represent a good medium for giving herbal extracts direct access to inflamed tissues2. Alcohol- or oil-based herbal liniments allow for penetration deeper into tissues, making the active constituents even more effective therapeutically.

The formulation of herbal liniments from Datura leaves presents a potential method for herbal pain relief and inflammation management. The wound healing and anti-inflammatory activity of Datura leaf extracts have been authenticated in various studies, highlighting their applicability as topical preparations4. Nevertheless, since toxic alkaloids are present in Datura, proper detoxification and standardization processes are essential to providing such preparations safe and effective1.

This study intends to formulate a herbal liniment preparation from detoxified Datura leaves and analyze its physicochemical characteristics and therapeutic value. The research also intends to emphasize the significance of

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traditional medicinal plants in contemporary topical treatments, thereby contributing to the establishment of cost-effective and effective herbal medicines.

**Benefits of dhatura leaves liniments:**

1. Pain Relief: Dhatura leaves help relieve muscle, joint, and nerve pain due to their analgesic properties.
2. Anti-inflammatory: They reduce swelling and inflammation in conditions like arthritis and bruises.
3. Muscle Relaxation: The liniment helps relax tense muscles and eases muscle cramps.
4. Antibacterial & Antifungal: Dhatura liniments can prevent infections and treat minor skin wounds and fungal issues.
5. Respiratory Relief: Applied to the chest, Dhatura liniment can help with breathing difficulties like asthma and congestion.
6. Skin Healing: It can soothe itching, rashes, and promote healing of minor burns and skin irritations.

**Plant Profile:**

Scientific name: Datura stramonium
Common name: Jimson Weed, Devil's Trumpet, Thorn Apple, Moonflower
Biological source: Consist of the dried leaves and flowering top of the Datura metel.


A. Plant of Dhatura


B. Flower Of Dhatura


C. Fruit of Dhatura


D. Leaves of Dhatura


E. Dride Leaves Of Dhatura

Figure No. 1: ABCD Parts of Datura stramonium

**Botanical classification:**

| | |
|---|---|
| Kingdom | Plantae |
| Division | Angiosperms |
| Class | Eudicots |
| Order | Solanales |
| Family | Solanaceae |
| Genus | Datura |
| Species | Datura stramonium |

Table no. 1: Botanical classification

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**Plant Description:**

Datura stramonium, commonly known as Dhatura, is an annual herbaceous plant found in many parts of the world. The plant can grow between 3 to 5 feet in height, with some varieties reaching up to 6 feet. The plant is recognized for its striking trumpet-shaped flowers, which vary in color from white to purple. The plant produces spiny capsules that contain

numerous small, black seeds. The leaves of the Dhatura plant are large, ovate, and coarse, with a dark green color. They have a rough texture and are typically 5 to 12 inches in length. The leaves are serrated (toothed) along the edges and have a characteristic strong odour when crushed6.

**Geographical Distribution**

Datura stramonium is native to North America, but it has spread widely and is now found in many parts of the world, including Europe, Asia, and Africa.

It thrives in well-drained, sunny areas, often growing as a weed in disturbed soils, roadsides, and agricultural fields. Dhatura grows best in warm climates and is sensitive to frost7.

**Chemical Composition:**

Table no. 2: chemical constituents in dhatura

| Compounds | Class | Properties | Uses & effects |
|---|---|---|---|
| Atropin | Tropane alkaloids | Anticholinergic, antimuscarinic | Used in medicine for pupil dilation, muscle Relaxation, anti-nausea. Toxic in high dose. |
| Scopolamine | Tropane alkaloids | Anticholinergic, sedative, antimuscarinic | Used for motion sickness and sedation. Can cause delirium in high dose. |
| Hyoscyamine | Tropane alkaloids | Anticholinergic, antispasmodic | Remove Muscle lead spasm & abdominal pain. Toxic if ingested in excess. |
| Solanine | Glycoalkloids | Toxic compounds | Causes nausea, vomiting & diarrhea when ingested in large amounts. |
| Cuscohygrine | Tropane alkaloids | Sedative, nervine | Has a calming effect, but its toxicity limits use. |
| Scopolamine N-oxide | Tropane alkaloids | Sedative, anti- nausea | Used for treating motion sickness and nausea, through dangerous in high dose. |

**Medicinal uses of dhatura leaved6, 7 :**

1. Pain Relief: Dhatura leaves are applied externally to reduce joint pain, muscle aches, and neuralgia due to their analgesic properties.
2. Anti-inflammatory Action: Poultices made from the leaves help decrease swelling and inflammation in cases of rheumatism and arthritis.
3. Treatment of Respiratory Disorders: Traditionally, the dried leaves were smoked to relieve symptoms of asthma, bronchitis, and chronic cough, owing to their bronchodilatory effects.
4. Antispasmodic Activity: The alkaloids present in Dhatura leaves act as muscle relaxants, helping to control muscle spasms and cramps.

5. Sedative Effect: In controlled doses, extracts from the leaves have been used to promote calmness and relieve anxiety.
6. Wound Healing: Topical application of leaf extracts is believed to aid in wound healing and reduce skin irritation.
7. Relief from Toothache: A small amount of leaf juice is sometimes applied to the gums to reduce toothache and oral pain.

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## MATERIAL

Table no. 3: Composition of Ingredients

| Ingredients | Quantity | Purpose |
|---|---|---|
| Dhatura Leaves Extract | 10 % w/v | Active herbal Ingredient, provide analgesic & Anti-inflammatory effects. (contain alkaloids, atropin, scopolamine). |
| Camphor | 3 % w/v | Provide a cooling effect, enhancing pain relieving action. |
| Coconut Oil | 85 % v/v | Carrier medium, facilitates Absorption into skin. |
| Ethanol | 2 % v/v | Enhancing soothing effect and penetrability. |
| Methyl Paraben | 0.2 % w/v | Improves shelf life |
| Eucalyptus Oil | 0.1-0.2 % v/v | For fragrance |

## II. METHODOLOGY

**1. Extraction process of dhatura leaves:**

The extraction of Dhatura stramonium leaves was carried out using the cold maceration method, which is widely used for obtaining heat-sensitive phytoconstituents. Freshly collected Dhatura leaves were first washed with distilled water to remove dirt and impurities. The cleaned leaves were shade-dried for 7–10 days to prevent active constituents and then convert into coarse powder using a mechanical grinder.

About 50 grams of powdered leaves were transferred to a clean, dry conical flask and macerated in 500 mL of 70% ethanol ( drug to solvent ration is 1:10 w/v ). Ethanol is used as solvent due to its ability to dissolve a broad range of phytochemicals. The mixture was sealed and kept at room temperature (25 ± 2°C) for 72 hours with intermittent shaking 2–3 times a day to enhance extraction of bioactive compounds. The extract was filtered after the maceration time using muslin cloth and then Whatman No.1 filter paper.

The filtrate was then concentrated over a water bath at 45–50°C till a semi-solid mass was obtained. The concentrated extract was kept in a covered container under refrigeration until used further for preparation of the herbal liniment. Maceration process is especially effective to extract alkaloids, glycosides, tannins, and other phytochemicals present naturally in Dhatura stramonium11.

A. Fresh Leaves Of Dhatura

B. Drying Of Leaves

C. Maceration Of Dhatura

D. Filtration of Extract


E. Concentration of filtrate

Figure no. 2: Extraction Process Of Dhatura Leaves

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2. Method of preparation of Herbal liniments12, 13 :

Preparation of Liniment Base:

- Measure 85 mL of coconut oil and transfer it into a clean & dry beaker.
- Gently heat the oil to approximately 40°C to facilitate the incorporation of other ingredients.

Incorporation of Dhatura Extract:

- Then add 10 g of the prepared Dhatura extract to the warmed base oil with continuous stirring to ensure uniform mixing.
- Then take 3 gm of camphor powder add into ethanol stir until dissolve it. after that those camphor mixture add into the oil base with continuous stirring.
- Incorporate 0.2 g of a methyl paraben to prevent microbial growth and enhance shelf life.
- Once the liniment has cooled to below 40°C, add 2–3 drops of a Eucalyptus oil to improve the fragrance and user acceptability.
- Filter the final mixture through filter paper to remove any undissolved particles.
- Transfer the prepared liniment into clean, sterile amber glass bottles.

**EVALUATION TEST FOR HERBAL LINIMENT:**

1. Organoleptic test:

To evaluate the physical properties of the serum gel formulation by sensory observation. A known quantity of liniments was put into a clean, clear glass vial. Visual appearance was evaluated under daylight, smell was measured directly, and texture and consistency were tested by touch and spreading on the skin.

2. Ph test:

To determine the pH of the herbal liniment of dhatura leaves to ensure it falls within the skin- friendly range (typically pH 4.5–7.5), which is essential for preventing skin irritation and maintaining product stability.

Method:

- Take 1 mL of the herbal liniment formulation.
- Dilute it with 10 mL of distilled water in a clean beaker.
- Stir the mixture gently to ensure uniform dispersion.
- Measure the pH of the diluted sample using a calibrated digital pH meter.
- Perform the test in triplicate for accuracy, and take the average of the readings.

3. Skin irritancy test:

To evaluate the skin irritation potential of the herbal liniment on a larger sample size (10 volunteers), ensuring the formulation is safe for broader application and does not cause any allergic reactions or skin irritations.

Method:

- Clean the forearm area of the volunteer and dry it thoroughly.
- Apply a small amount of the herbal liniment (0.5–1 mL) to a sterile gauze pad, and tape it securely to the skin.
- Leave the patch on for 24 hours without disturbance. After removal, observe the test area for any signs of irritation, such as redness, swelling, or itching.
- Observe the skin for an additional 48 hours to detect delayed reactions.

4. viscosity test:

To assess the viscosity of the herbal liniment, which is crucial for determining its spreadability, ease of application, and user experience. The appropriate viscosity ensures that the liniment is neither too runny nor too thick for effective topical application.

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Method:
- Take a sufficient amount (approximately 10 mL) of the herbal liniment formulation.
- Use a Brookfield viscometer with the appropriate spindle (e.g., spindle 5 or 6) depending on the expected viscosity range.
- Set the viscometer to rotational speed (e.g., 30 rpm) to simulate typical application conditions.
- Immerse the spindle in the liniment sample and record the viscosity reading in centipoise (cP).
- Perform the test at room temperature (25 ± 2°C) for consistency.
- Conduct the test in triplicate and record the average viscosity to minimize any experimental error.

5. Spreadability test:
To assess the ease of spreading and uniform distribution of the herbal liniment on the skin. This test is important for determining how well the liniment will apply and cover the treatment area without excessive effort.
Method:
- Take a fixed amount of the herbal liniment (approximately 1-2 mL) and place it in the center of a clean glass plate.
- Place a second glass plate (or any flat surface) above the first plate. The top plate should be smooth and transparent for easy observation of the spread area.
- Apply a fixed weight (approximately 50–100 g) onto the top plate to simulate the amount of pressure that would typically be exerted during application.
- Allow the weight to remain for 1–2 minutes.
- After this period, measure the diameter of the spread area from the center of the liniment to the edges of the spread zone.
- Repeat the test at least three times to ensure consistency.

6. Homogeneity test:
To evaluate the physical uniformity of the formulated herbal liniment to ensure even distribution of active ingredients and consistency in appearance.
Method:
A small amount of liniment was taken and spread on a clean glass slide using a sterile spatula. The sample was visually examined under adequate lighting to assess:
o Presence of lumps or particulate matter
o Uniformity of the formulation
o Phase separation or sedimentation
Additionally, a drop of the liniment was rubbed gently between the fingers to evaluate texture and consistency.

7. Antimicrobial test:
To evaluate the antimicrobial activity of the formulated Datura-based herbal liniment against selected microbial strains.
Method:
- MRS agar medium was prepared using 100 ml of distilled water.
- The medium was autoclaved at 121°C for 15 minutes.
- After cooling to around 45–50°C, the medium was poured into sterile Petri dishes.
- After solidification, the agar plates were inoculated with the test microbial culture.
- Different concentrations (1%, 2.5%, and 5%) of the herbal liniment were applied to the surface.
- Plates were incubated at 37°C for 24 hours.
- The zone of inhibition was measured in millimetres.

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## III. RESULT AND DISCUSSION

1. Organoleptic test:

Table no.4: Result of Organoleptic test

| Test | Result | Inference |
|---|---|---|
| color | Pale green to yellowish green | Acceptable and uniform |
| Odour | Characteristic | Pleasant and natural |
| Texture | Smooth, non-sticky | Suitable for topical use |
| Appearance | Clear, non-greasy liquid | Appropriate for liniments |
| Consistency | Thin, easily spreadable | User-friendly application |

2. Ph test:

The pH of the herbal liniment of dhatura leaves was found to be 6.60, which is within the acceptable range for topical application and is unlikely to cause skin irritation.

3. Viscosity test:

Table no. 5: result of Viscosity test

| Trial | Viscosity | Average |
|---|---|---|
| 1. | 1500 cp | |
| 2. | 1485 cp | 1491 cp |
| 3. | 1490 cp | |

The average viscosity of the liniment was found to be 1491 cP, which indicates a moderately thick consistency, ideal for easy application without dripping but ensuring effective spreadability on the skin.

4. Skin irritancy test:

Table no. 6: result of skin irritancy test

| Participants | Observation | Result |
|---|---|---|
| 1 | No reaction | Negative |
| 2 | No irritation, redness or swelling | Negative |
| 3 | No reaction | Negative |
| 4 | No irritation, redness or swelling | Negative |
| 5 | Mild itching, no swelling | Negative |
| 6 | No reaction | Negative |
| 7 | No reaction | Negative |
| 8 | Mild redness,no swellii | Negative |
| 9 | No irritation, redness or swelling | Negative |
| 10 | No reaction | Negative |


DOI: 10.48175/IJARSCT-26130

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Out of the 10 volunteers, no serious reactions (such as swelling, severe redness, or blistering) were observed. A few mild instances of redness or itching were noted but did not indicate a major allergic response. Based on these results, the liniment is considered safe for use on the skin for most individuals.

5. Spreadability test:

Table no. 7: Result of spreadablity test

| Trail | Spread diameter (cm) | Result | Average |
|---|---|---|---|
| 1. | 4.5 cm | Good spreadability | |
| 2. | 4.2 cm | Good spreadability | 4.37 cm |
| 3. | 4.4 cm | Good spreadability | |

The average spread diameter was 4.37 cm, indicating that the herbal liniment has good spreadability and is easy to apply on the skin without being too thick or too runny.

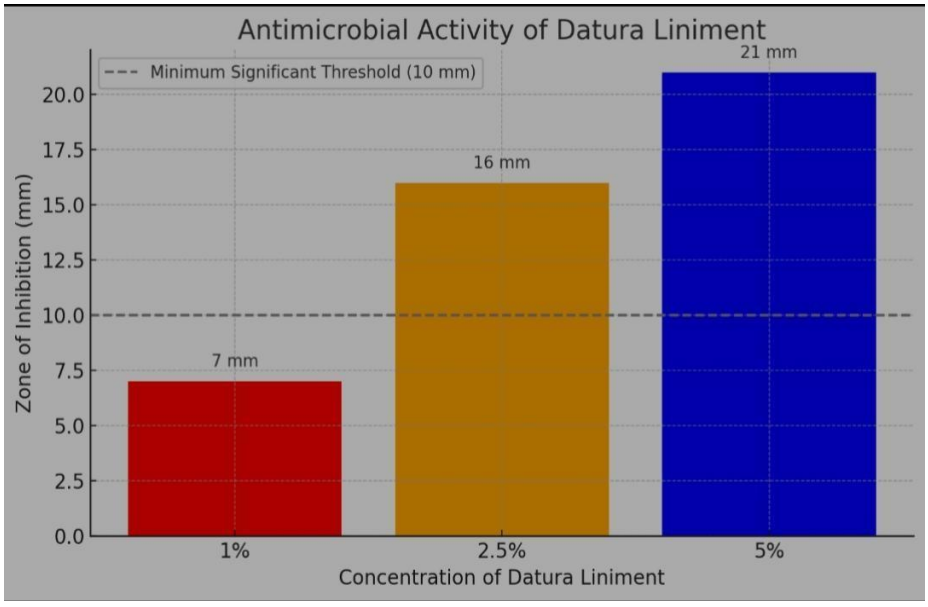
6. Homogeneity test:

The liniment appeared smooth, uniform, and free from lumps or phase separation, indicating good homogeneity. The formulation passed the homogeneity test, confirming even dispersion of ingredients and suitable consistency for topical Application.

7. Antimicrobial test:

Table no. 8: Reault Of Antimicrobial Test

| Concentration | Zone of inhibition | Activity |
|---|---|---|
| 1 % | 7 mm | Not significant |
| 2.5 % | 16 mm | Significant |
| 5 % | 21 mm | Strong |




Graph no. 1: Antimicrobial Activity

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The Datura liniment showed a concentration-dependent antimicrobial effect. At 1% concentration, the zone of inhibition was only 7 mm, which is below the significant threshold, indicating minimal activity. At 2.5%, the inhibition zone was 16 mm, suggesting notable antimicrobial action. The 5% concentration showed a 21 mm zone of inhibition, confirming strong antimicrobial effectiveness.

## IV. DISCUSSION

The herbal liniment prepared with the help of Datura stramonium leaf extract, ethanol, camphor, eucalyptus oil, and methyl paraben showed potential in providing local relief from pain and inflammation. Leaves of Datura possess alkaloids such as atropine and scopolamine, which have analgesic and anti-inflammatory properties4. Datura extracts heal the wound more effectively and lower inflammation, justifying their incorporation in local preparations.

Ethanol was used both as a solvent in extracting phytochemicals and as a penetration enhancer for enhancing absorption in the skin. Camphor and eucalyptus oil were employed as counterirritants and produced a sense of warming followed by cooling which aids in giving relief from muscular pain. Methyl paraben was added for microbial stability and shelf life. The last formulation also demonstrated good physical attributes like consistent texture, simplicity in application, within acceptable pH, and lack of phase separation and microbial growth when observed short term. Such findings indicate that the liniment is stable as well as applicable for external use. In general, the preparation blended age-old herbal lore with contemporary scientific methods, giving credence to the promise of Datura liniments as herbal topical treatments. Future research may investigate long-term stability and clinical effectiveness4.

## V. CONCLUSION

This research focused on the development of a herbal liniment from Datura stramonium leaf extract, blended with ethanol, camphor, eucalyptus oil, and methyl paraben. The liniment was designed to take advantage of the natural analgesic and anti-inflammatory activities of Datura, backed by scientific literature and traditional practices. The formulation had good physical characteristics like appropriate pH, consistency, spreadability, and stability. Ethanol contributed to extraction and skin penetration, while camphor and eucalyptus oil offered other counterirritant and soothing properties. Methyl paraben provided microbial preservation. The results show that the liniment is safe for external use and effective in alleviating localized pain and inflammation.

This study proves the efficacy of Datura-based liniment as a natural substitute to synthetic topical agents. Nevertheless, additional in vivo experiments and dermal safety testing are suggested in order to affirm its therapeutic efficiency and guarantee its safe application

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