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# Formulation and Evaluation of Herbal Gel Containing Root Extract of *Mimosa Pudica* (Lajjalu)

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**KEYWORDS**

*Mimosa pudica*, Gel, Methanolic, Herbal, Root extract, Wound healing.

**ABSTRACT:**

**Introduction:** Traditional medicines are a vital part of healthcare systems. Plants and plant extracts are the primary source of health treatment for majority of the global population. The present study is aimed at formulating topical gel using methanolic extract of *Mimosa pudica* plant. It is also known as lajjalu, belongs to the Fabaceae family. It contains mimosine and turgorin. Herbal gels have greater shelf life, non-toxic, safe, effective, eco-friendly and biocompatible.

**Materials and Method:** The gel was prepared using the Carbopol 934 and dried methanolic extract of lajjalu roots. Gel was evaluated for its pH, appearance and homogeneity, viscosity, spreadability, drug content, skin irritation studies and drug diffusion studies.

**Results and Discussion:** The gel had brownish colour with a semi-solid appearance, smooth on application, optimum viscosity, and pH values ranged from 6 to 7. The gel was homogeneous without gritty particles, evenly distributed, extrudability was good, and gel does not produce any irritation, redness on application. Drug content was 89.72%. The diffusion test resulted in good drug release.

**Conclusion:** The present research suggests that lajjalu gel formulation hold tremendous promise as a safe and effective topical gel. The herbal gel can be considered a potential candidate for topical applications in treating wounds, skin infections, and inflammation.

## 1. Introduction

All around the world, traditional medicines are a vital part of healthcare systems. Plants and plant extracts are the primary source of health treatment for majority of the global population. Due to their diverse classes of phyto-chemicals, several Indian herbal plants are associated with a range of pharmacological effects.

Gel is a thin transparent or translucent non greasy preparations meant for external application to the skin. Lajjalu gel is a one among the herbal gel which is new dosage formulation and more acceptable by society as they are much convenient for external application. The main action of it is on the wound healing [1]. These kinds of gels are having a lot of advantages over conventional dosage forms in minimizing the side effects and increasing the therapeutic efficacy.

In ancient era people were using Kastaushadhi lepa which is inconvenient to carry with respect to convenience and shelf life. Gels are best one because these herbal gels are having greater shelf life, non-toxic, safe, effective, eco-friendly and biocompatible. These offer fantastic adhesion to the application region, compared to other formulations, gels are simple to manufacture even in house also to rectify the problem of people and to make the usage of

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the product easy, an attempt will be made to convert lajjalu extract into gel dosage form which is abundantly present in our surrounding area. So for the preparation of lajjalu extract into gel for wound healing reference is taken from the text Rajanighantu [1].

*Mimosa pudica* is known as lajjalu belongs to the fabaceae family. All the parts of the plant including stem, leaves, fruit, root and flower are used in various ayurvedic herbal preparations. It grows in waste lands of tropical regions in India. Lajjalu shows antiviral, spasmogenic, diuretic, constipating, febrifuge, wound healing, Hyperglycemic, and Antifertility activities. *Mimosa pudica* contain phyto-constituents such as mimosine and turgorin. The periodic leaf movements exhibited by the plant are due to the presence of derivatives of 4-O- gallic acid. The aerial part of the plant *Mimosa pudica* contains C- glycosylflavones, 2-Orhamnosylorientin.The root of the plant contains 10% tannin and 55% ash. The seed contains mucilage.mimosa pudica has wound healing activity. Hence the present study is aimed at formulating and evaluation of effective lajjalu topical gel using methanolic extract of root of *Mimosa pudica* plant.

**Figure 1. (a) *Mimosa pudica* plant, (b) Roots of *Mimosa pudica***

## 2. Material and Methods

### Collection of Raw material

Lajjalu plant raw material collected from Dorley Ayurvedic store Kolhapur and also from Panchaganga river side. Then we have separated roots of lajjalu. Then the plant was authenticated. The roots were cleaned and dried completely. Then it was subjected to milling machine for making coarse powder of lajjalu roots.Methanol was used as a solvent for extraction, whatmann filter paper, anhydrous $CuSO_4$ was collected from Karmalkar Company in Kolhapur.

Raw materials for gel preparation such as carbopol 940, Demineralized water,
TEA, Phenoxyethanol were collected from cilia cosmetic natural cosmetic raw material supplier.

### Methods

For the study we are choosing methanolic root extract of Lajjalu plant because the methanolic extract exhibited well wound healing activity probably due to phenols constituents [2].

Soxhlet Extraction also known as countinous hot extraction method is utilized for the extraction of Lajjalu roots. The apparatus known as soxhlet extractor, made up of glass, consists of Round bottom flask, extractor chamber, siphon tube and condenser at top. The reason using Soxhlet extraction method is because larger amount of drug can be extracted with smaller amount of solvent [3].

### Preparation of Extract

Lajjalu plant samples were collected and authenticated, cleaned, dried and coarsely powdered using a milling machine. The powdered material was transferred into thimble and kept in soxhlet extractor chamber. Methanol was placed in round bottom flask connected with condensing unit. The condensing unit is fitted with inlet and outlet tube and then round bottom flask was mounted over heating mantel. Switch on the heating mantel and temperature was gradually raised 10°C every 10 min till it reaches to 60°C. When temperature reaches 60°C, vapours of methanol started to move inside condensing unit by vapour path percolated as liquid drop in soxhlet extractor over the thimble which contains raw material of lajjalu root powder. When the soxhlet extractor chamber gets filled with liquid drops of percolated methanol, it gets transferred into siphon arm gradually. As soon as siphon gets completly filled it emptied again into Round bottom flask as Extract by Extractor path. This is called one cycle this procedure is countinued in same way as explain above with same Ingredients for 72 hours. Then extractor was filtered

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through a whatmann filter paper and concentrated using a rotatary evaporator then dried in a dessicator over anhydrous $CuSO_4$. The powdered residue was transferred into vials and stored at 4°C in airtight vials before analysis [4].

**Preparation of Herbal gel**

**Ingredients**

The gel was prepared using the dried methanolic extract of Lajjalu roots sing Carbopol-940 as a gelling agent. As the work on evaluation of wound healing activity of root of *Mimosa pudica* has proved that gel containing 2% (w/w) methanolic extract exhibited significant wound healing activity. So we have taken ingredients as mentioned in below proportions (Table1).

**Table1. Components of Gel Preparation**

| | |
|---|---|
| Lajjalu extract | 2 gram |
| Demineralised water | 100 mL |
| Carbopol | 0.8 gram |
| TEA | 20 drops |
| Phenoxyethanol | 0.2 mL |

**Procedure**

Take demineralized water 100 ml and extract of Lajjalu 2 gram. Mix it well and add carbopol 940 about 0.8 gram mix it until it dissolves completely wait for 3 hours filter it well. Then add TEA (Triethanolamine) drop by drop upto 20 drops. Finally, gel like consistency will be obtained. Then add 0.2 ml of Phenoxyethanol as preservative [5].

**Evaluation of Formulated gel**

Following parameters were used for the evaluation of prepared Lajjalu root extract gel: [6,7,8]

**Homogeneity**

Following the setting of the gels in their respective containers, all developed gels underwent homogeneity testing through visual inspection. Evaluation encompassed scrutinizing their appearance and detecting any presence of aggregates within the gel matrix [6,7,8].

**Grittiness**

Microscopic evaluation was conducted on all formulations to detect the presence of particles. No appreciable particulate matter was observed under light microscopy, indicating that the gel preparation met the requirement of being free from particulate matter and grittiness, as desired for any topical preparation [6,7,8].

**Excrudability study**

Effective extrusion of the gel occurs with gentle pressure. The extrudability of formulation from aluminum collapsible tubes was gauged with a universal tube filling machine. Tubes filled with 10g gels were secured between clamps, then compressed to ascertain the weight in grams necessary to extrude a 0.5 gm ribbon of gel within 10sec timeframe/interval [6,7,8].

**Measurement of pH**

To determine the pH of gel formulations, a digital pH meter was employed. One gram of gel was dissolved in 100 ml of distilled water and left to stand for two hours. pH measurements were conducted in triplicate for each formulation and average value were subsequently computed [6].

**Drug content**

Drug content was assessed through spectrophotometric analysis, where absorbance measurements were taken to determine the concentration [6].

**Viscosity study**

Using a Brookfield viscometer, the viscosity of the prepared gel was measured by rotating the gels at speeds of 100 rpm with spindle no 1. Dial readings were recorded for each speed to determine viscosity [6].

**In-vitro diffusion studies**

The in vitro diffusion studies of the prepared gel were conducted using a Keshary-Chien diffusion cell with a cellophane membrane acting as the barrier. Dialysis Membrane-150 (synthetic membrane) was used as the semi-permeable membrane. It was soaked in the medium for overnight before the study. A total of 100 milliliters of phosphate buffer served as the receptor compartment, while 1 gram of the gel was evenly applied to the cellophane membrane. The donor compartment remained in constant contact with the

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receptor compartment, with the temperature carefully maintained at 37±0.5 °C throughout the experiment. Stirring of the solution in the receptor compartment was achieved using externally driven Teflon- coated magnetic bars at specific time intervals. At each interval, 5 ml solution from the receptor compartment was pipetted out and promptly replaced with fresh 5 ml phosphate buffer. The drug concentration in the receptor fluid was subsequently determined spectrophotometrically against an appropriate blank [6].

**Spreadability**

Spreadability, a critical criterion for an ideal gel, refers to its ability to effortlessly cover a wide area upon application to the skin or affected part, significantly influencing the therapeutic effectiveness of the formulation. This characteristic is quantified by the time it takes for two slides, bearing a specified load and sandwiching the gel, to separate. A shorter separation time indicates superior spreadibility. This parameter is calculated using the formula:

$S = M^* L/T$

Where,

M represents the weight attached to the upper slide, L denotes the length of the glass slides, and T specifies the time taken for the S to part ways [9].

**Skin irritation studies**

Healthy volunteers participated in a skin irritation test, where 100 mg of gel was applied to a 2 cm area on the inner surface of the upper arm for 15 minutes, followed by covering with a cotton bandage. After 15 minutes, the application sites were cleansed with acetone, and assessments were conducted based on the Draize scale: 0 for no irritation, 1 for slight irritation, and 2 for noticeable irritation [9].

## 3. Results

**Physical evaluations of gel formulation**

The herbal gel was prepared using Carbopol 934, various concentrations of methanolic extract from root of *Mimosa pudica* methanolic extract, distilled water, and triethanolamine. Prepared gels were subjected for appearance, spreadability, pH, and homogeneity, grittiness, etc. and results of viscosity are tabulated in Table 2 and remaining parameters data shown in Table 3. The gel formulations have brownish colour with a semi-solid appearance and have smooth feel on application. All these formulations have shown optimum viscosity. The pH values of all prepared formulations ranged from 6 to 7 which is considered acceptable to avoid the risk of irritation on application to the skin. The prepared formulation was found homogeneous without any gritty particle. The spreadability value suggest that the gel can effortlessly distributed.

**Extrusion of the gel**

The extrusion of the gel from the tube is an important during its application and in patient acceptance. Gels with high consistency may not extrude from tube, whereas low viscous gels may flow quickly, and hence, suitable consistency is required to extrude the gel from the tube. Extrudability of the gel formulations was found to be good.

**Skin irritation study**

Results of skin irritation test indicated that prepared gel does not produce any irritation, redness, or edema on application.

**Drug content**

It was assessed to determine the concentration of drug for therapeutic effect was found good about 89.72%.

**Table 2. Viscosity of Prepared gel**

| Sample | A |
|---|---|
| Spindle | 100 |
| RPM | 100 |
| Temp.(°C) | 25.0 |
| FSR (%) | 41.36 |
| Viscosity(cP) | 775.3 |
| Holdtime | 30 Sec |
| Runtime | 60 Sec |

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**Table 3. Result of evaluation parameters of Lajjalu gel**

| Test | Results |
|---|---|
| Colour | Brownish |
| Odour | Characteristics |
| Form | Semi-solid Gel |
| Nature | Homogenious |
| Homogeneity | +++ ( Excellent) |
| Grittiness | Fine and smooth |
| Excrudability study | Passes |
| Skin irritation studies | 0 (no irritation) |
| Measurement of pH | 6.05 |
| Drug content | 89.72% |
| Viscosity study | 775.3cp |
| Spreadability | 5.4 cm |

**In-vitro drug diffusion of *Mimosa pudica* gel**

The diffusion test was carried out for 6 hours at various time intervals of 30, 60, 120, 240, 360 min. The % Cumulative Drug Dose (CDD) are tabulated below in table 4 and depicted in figure 2.

**Table 4. Drug diffusion of *Mimosa pudica* Gel**

| Time (min) | % CDD |
|---|---|
| 30 | 5.603268338 |
| 60 | 9.66367688 |
| 120 | 18.94408542 |
| 240 | 28.08490251 |
| 360 | 43.34571959 |

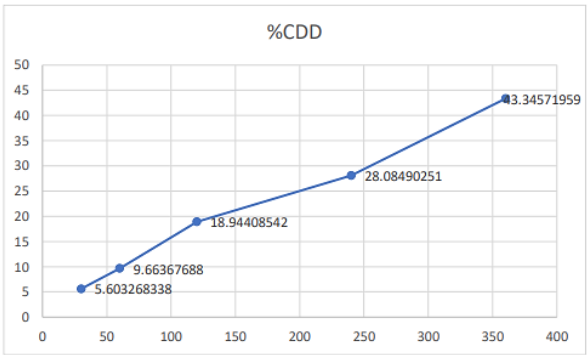


**Figure 2. % CCD of *Mimosa pudica* Gel**

**Antioxidant activities of the samples**

**DPPH free radical scavenging assay**

The radical-scavenging activities of the samples were studied using the stable DPPH radical, as described by Blois (1958) with some modifications (Sudarshan et al., 2019). Different concentrations (20 to 100 µg/mL) of samples and 2 mL of DPPH (100 µM) was added, made up to 3 mL with methanol and the reaction mixture was incubated in dark for 45 min at room temperature. At the end of incubation period, absorbance was recorded using spectrophotometer (Shimadzu UV-1800, Kyoto, Japan) at 517 nm against the blank (Without sample/Standard). Free radical scavenging capacity of the samples were calculated and expressed in IC50 values in comparison with Ascorbic acid as a standard antioxidant.

**Sample D**

10. 1.185. 35.06849

20. 0.984. 46.08219

30. 0.864. 52.65753

40. 0.694. 61.9726

50. 0.517. 71.67123

| Con (µg/mL) Blank Std. Vit-C 0 | OD 1.351 | % Inhibition | IC 50 (µg/mL) |
|---|---|---|---|
| 0 | 1.825 | 0 | |
| 10 | 0.924 | 49.36986 | |
| 20 | 0.747 | 59.06849 | 10.90355 |
| 30 | 0.564 | 69.09589 | |
| 40 | 0.397 | 78.24658 | |
| 50 | 0.185 | 89.86301 | |

**Discussion**

The work chosen for the present study focuses on the pharmaceutical modification of lajjalu extract into gel and its evaluation. In this study, we referred to the Ayurvedic text Rajanighantu for information on lajjalu's wound healing properties. Additionally, we selected the methanolic extract of the roots of the lajjalu plant for our study, as it demonstrated significant wound healing activity, likely attributable to its phenolic constituents.

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The lajjalu gel was prepared and evaluated for physicochemical analysis. The lajjalu gel exhibited desirable characteristics, including smooth texture without any presence of matter, aggregates, clogging or lumps, indicating a well formulated system. This gel also shows very good Antioxidant property.

The pH of gel was found 6.05 while viscosity of gel was 775.3 cp, crucial for factors such as spreadability and drug release. comparative analysis of various parameters such as viscosity, drug content, PH, spreadability, extrudability, invitro drug diffusion, and skin irritation yield satisfactory outcomes.effective gel was characterized by their quick Spreadability on the surface, requiring minimal time for application. The spreadability values suggest that the gel can be effortlessly distributed with minimal shear force. Additionally, ensuring easy extrusion from the tube during application is vital for patient compliance. Encouragingly, the Excrudability values of gel was deemed satisfactory.

**Conclusion**

The belief that natural remedies are safer with fewer side effects than synthetic ones has led to their increased acceptance. This has driven a growing demand for herbal formulations in the global market. The gel formulations met various pharmaceutical standards indicating safe topical gel. The present research suggests that lajjalu gel formulation hold tremendous promise as a safe and effective topical gel. The formulation and evaluation of the herbal gel containing root extract of *Mimosa pudica* (Lajjalu) were successfully carried out. The gel exhibited desirable physical characteristics, including smooth texture, appropriate pH, and adequate viscosity. The parameters would suggest that the root extract of *Mimosa pudica* retains its therapeutic properties when formulated into a gel. The herbal gel can be considered a potential candidate for topical applications in treating wounds, skin infections, and inflammation. Further studies could be directed towards clinical evaluations and exploring the formulation's scalability for commercial production.

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