World Journal of Biology Pharmacy and Health Sciences
eISSN: 2582-5542
Cross Ref DOI: 10.30574/wjbphs
Journal homepage: https://wjbphs.com/

(RESEARCH ARTICLE)

Check for updates

# Exploring herbal synergies: the efficacy of *Pergularia daemia* and co-herbs in reducing pain, swelling and inflammation

Vaishnavi Manohar Raut *, Nagesh Baswraj Swami and Gajanan S. Sanap

*Late Bhagirathi Yashwantrao Pathrikar College of Pharmacy Pathri, TQ. Phulambri, Dist. Chhatrapati Sambhajinagar 431111, India.*

World Journal of Biology Pharmacy and Health Sciences, 2024, 19(01), 001–017

Publication history: Received on 05 May 2024; revised on 24 June 2024; accepted on 27 June 2024

Article DOI: https://doi.org/10.30574/wjbphs.2024.19.1.0360

## Abstract

The growing interest in herbal formulations is due to chronic illnesses, concerns about synthetic medications' safety, and the importance of natural health approaches. Herbal formulations offer a natural, affordable, and accessible therapy option with better tolerability and fewer side effects. The purpose of this study was to develop and evaluate the possible anti-inflammatory and pain relief and swelling reduction properties of herbal lep powders made from *Pergularia daemia*, red ochre, *Boswellia Serrata*, camphor, *Albizia lebbeck*, and mango ginger. These plants were chosen for their ethnomedical applications because to their documented swelling reduction, pain relief and anti-inflammatory qualities. The different botanicals were ground into fine powders and blended in the proper ratios to create the herbal lep powders. To evaluate the powders' bulk density, flow characteristics, and particle size distribution, physicochemical characterisation was carried out. In addition, a qualitative examination of the powders' color, texture, and Odor was done. The physicochemical parameters of the prepared herbal lep powders were found to be good, suggesting their appropriateness for topical administration. The powders also exhibited favourable organoleptic properties, which increased their acceptability for application. Although this study did not include clinical or preclinical studies, its results set the stage for future investigations into the therapeutic efficacy and safety of herbal lep powders in the treatment of pain and inflammation. In general, the process of creating and assessing these herbal lep powders shows promise in the field of creating natural treatments for inflammatory ailments.

**Keyword:** *Pergularia daemia*; *Boswellia Serrata*; *Albizia lebbeck*; Herbal powders; Qualitative; Swelling; Pain relief; Anti-inflammatory

## 1. Introduction

India, known as the "botanical garden of the world," is a major producer of medicinal plant materials, with over 20,000 plants procured from 15 agro-climatic zones. India's traditional herbal medicine system is crucial for global healthcare, with 85-90% of the population using these remedies. The demand for herbal medicines has increased since the late 1990s, leading to increased interest in medicinal plant research among pharmaceutical professionals. With around 45,000 plants, 60% are used by practitioners and 40% are traditionally [1].

Chronic ailments, worries about the safety of synthetic pharmaceuticals, and the value of natural health practices have all contributed to the increased interest in herbal formulations. Herbal remedies provide a more benign, cost-effective, and easily available treatment choice with few adverse effects [2]. Standardization, quality assurance, safety, and regulatory matters are still not well understood, nonetheless. A time-tested technique with deep roots in traditional medical systems around the globe is the preparation of herbal pastes, or leps, as one of these natural medicines. In this, we'll talk about making a herbal paste with a range of widely used medicinal plants, such as camphor, ambehaldi, *Pergularia daemia*, *Boswellia Serrata*, and shirish powder.

* Corresponding author: VAISHNAVI MANOHAR RAUT

This herbal paste, or lep, is a potent blend of organic ingredients that have each been chosen with consideration for their unique pharmacological characteristics. With a focus on reducing swelling, providing pain relief, and having anti-inflammatory properties, this formulation offers a methodical approach to addressing common health concerns [3]. Because of the herbal paste's multifunctional properties, it may be used to cure a variety of ailments, including arthritis, strained muscles, skin irritations, and overall discomfort. With the help of this study, we seek to shed light on the selection process for each botanical component, elucidate their distinct therapeutic qualities, and outline the scientific approach to producing a herbal paste that maximizes their synergistic effects [4].

### *Aim and objectives*

**Aim:** Formulation and evaluation of herbal lep (powders). for reduction of swelling, pain and inflammation.

### *Objectives*

- To develop a standardized herbal lep formulation incorporating *Pergularia daemia*, Geru powder, Ambehaldi, Camphor, and *Boswellia Serrata*, optimizing the ratios and processing methods for maximum efficacy and reproducibility.
- Improve the formulation process to ensure consistency, stability, and maximum efficacy of the herbal lep, with particular emphasis on refining mixing techniques and storage conditions.
- Evaluate the efficacy of the herbal lep in reducing swelling, alleviating pain, and mitigating inflammation through direct application to affected areas in human subjects.
- Evaluate the safety profile of the herbal lep through observation of adverse reactions or side effects reported by human subjects during and after application.
- Establish quality control protocols and standardization procedures for the manufacturing process to ensure consistency and reproducibility of the herbal lep formulation.
- To contribute to the growing body of knowledge on herbal medicine and its integration into mainstream healthcare practices for the management of inflammatory conditions.

## 2. Experimental materials:

### 2.1. Plant Materials

#### *2.1.1. Pergularia daemia*

*Pergularia daemia*, a perennial herbaceous plant of the Apocynaceae family, can also be referred to as the White Vine. This species is indigenous to the Indian subcontinent and is distributed throughout Bangladesh, India, Sri Lanka, and some areas of Southeast Asia [5]. Typically, the plant grows in a variety of settings, including roadsides, scrublands, and open woodlands. Its twining vines, which may grow up to two meters in height and extend across surrounding vegetation, are what give it its distinctive appearance. *Pergularia daemia* has elliptic or ovate-shaped leaves that are glossy green in color and have a smooth texture [6].

**Figure 1** *Pergularia daemia*

Many traditional medical systems have historically employed *Pergularia daemia*. It is called "Utthama" in Ayurveda, the Indian traditional medical system, and is utilized for its therapeutic qualities [7]. Herbal medicines are made from various components of the plant, such as the leaves, roots, and seeds, to cure conditions like rheumatism, fever, coughing, and skin problems. It has also been investigated for its pharmacological qualities, such as antibacterial,

antioxidant, and anti-inflammatory effects ([8]). The bioactive components of *Pergularia daemia* and its possible therapeutic effects have been the subject of numerous pharmacological research. Numerous pharmacological actions, such as anti-inflammatory, antioxidant, antibacterial, and analgesic effects, have been reported for extracts obtained from diverse plant sections ([8,9]).

- Scientific Classification

**Table 1** Scientific Classification of *Pergularia daemia*

| **Rank** | **Scientific name & Common name** |
|---|---|
| Biological Name | *Pergularia daemia* |
| Phylum | Angiosperms |
| Class | Eudicots |
| Order | Gentianales |
| Family | Apocynaceae |
| Genus | *Pergularia* |
| Species | *Pergularia daemia* |
| Kingdom | Plantae |
| Other Name | Utran, Utamarani, Utraan, Trotu (Kathua). |

- Chemical Components

*Pergularia daemia* contains various chemical compounds, including alkaloids, flavonoids, glycosides, terpenoids, steroids, and saponins. Some specific chemical constituents identified in *Pergularia daemia* include pergularin, daemin, and pergulacetal. With various bioactive compounds contributing to its pharmacological effects ([10,11]). Some of the key chemical constituents identified in *Pergularia daemia* include:

  - Cardiac glycosides
  - Alkaloids
  - Flavonoids
  - Triterpenoids
  - Saponins
- Medicinal Uses
  - Anti-inflammatory: It is used to reduce inflammation, making it beneficial for conditions like arthritis and rheumatism (12).
  - Anti-edematous: It is known to reduce edema or fluid retention, which can contribute to swelling and inflammation in different parts of the body.
  - Musculoskeletal Disorders: It is used in folk medicine to ease symptoms of musculoskeletal disorders such as sprains, strains, and minor injuries by reducing swelling and pain (13).
  - Digestive Aid: It aids digestion and can be used to relieve digestive issues such as indigestion and constipation.
  - Respiratory Health: It is used in traditional medicine to alleviate respiratory problems like coughs and asthma.
  - Antimicrobial: *Pergularia daemia* exhibits antimicrobial properties and is used to treat infections, wounds, and skin disorders.
  - Diuretic: It has diuretic properties, promoting urine production and aiding in the elimination of toxins from the body.
  - Antioxidant: *Pergularia daemia* contains antioxidants that help protect cells from damage caused by free radicals.
  - Analgesic: It has pain-relieving properties and can be used to alleviate various types of pain (12,14).

*2.1.2. Ambehalad / Mango ginger*

The plant species known as mango ginger (*Curcuma amada*)., often referred to as "Manga Inji" or "Amba Haldi," is a member of the Zingiberaceae family's genus Curcuma. Mango ginger is made from the rhizomes of *Curcuma amada* rather than the ginger root, as opposed to ordinary ginger (Zingiber officinale). ([15]). Originally from India, this plant is

widely grown throughout Southeast Asia. Its unique mango-like flavour and perfume are what give it the nickname "mango ginger." Mango ginger rhizomes have an orange-yellow color with a tangy, somewhat spicy flavour that makes them a popular addition to pickles, chutneys, and traditional medicines [16].

Mango ginger has therapeutic uses and has been employed in traditional medical systems like Ayurveda. It is thought to have antioxidant, carminative, anti-inflammatory, and digestive qualities [17]. Mango ginger is also prized for its ability to heal respiratory conditions, coughs, colds, and gastrointestinal issues. Numerous scholarly inquiries have examined the phytochemical makeup and pharmacological properties of mango ginger. According to research, *Curcuma amada*'s rhizomes have bioactive substances such terpenoids, essential oils, phenolic compounds, and curcuminoids, which are responsible for some of the plant's many therapeutic benefits [18].

**Figure 2** Powder of Mango ginger

- Scientific Classification

**Table 2** Scientific Classification Of Mango Ginger

| **Rank** | **Scientific name & Common name** |
|---|---|
| Kingdom | Plantae |
| Phylum | Angiosperms |
| Class | Monocots |
| Order | Zingiberales |
| Family | zingiberaceae |
| Genus | Curcuma |
| Species | *Curcuma amada* |
| Biological Name | *Curcuma amada* |
| Other Name | Amragandhi haridra, aam haldi, ambe halad, amba haldar |

- Chemical Components of mango ginger includes:

Ambehalad contains various chemical compounds, including [19]:

  - Curcuminoids
  - Gingerols
  - Shogaols
  - Essential oils
  - Phenolic compounds
  - Terpenoids
  - Carbohydrates and dietary fibre
  - Amino acids
  - Phenolic compounds
- Medicinal Uses
  - Anti-inflammatory: Helps reduce inflammation and swelling in skin conditions like eczema, dermatitis, and insect bites (20).

- Antibacterial: Fights against bacteria on the skin's surface, aiding in wound healing and preventing infections.
- Skin-soothing: Calms irritation and redness, making it beneficial for soothing sunburns, rashes, and minor skin irritations.
- Antioxidant: Protects the skin from damage caused by free radicals, promoting skin health and preventing premature aging (20,21).
- Wound healing: Supports the healing process of minor wounds, cuts, and abrasions by promoting tissue repair and regeneration.
- Swelling: Can help reduce swelling by inhibiting inflammatory pathways and reducing fluid accumulation in affected tissues (22).
- Rheumatoid Arthritis: Mango ginger, a natural remedy with anti-inflammatory and analgesic properties, can alleviate joint pain, reduce inflammation, and improve mobility in individuals with rheumatoid arthritis (23,24 ).

*2.1.3. Bosswellia serrata*

The tree *Boswellia Serrata*, sometimes called Salai guggul or Indian frankincense, is indigenous to the dry, hilly regions of the Middle East, North Africa, and India. As a member of the Burseraceae family, it has been used for thousands of years for its medicinal qualities in traditional medical systems, including Ayurveda and traditional Chinese medicine ([25]). Many of the therapeutic effects of *Boswellia Serrata* are thought to be attributed to the bioactive chemicals called boswellic acids found in the resin that is collected from the bark of the plant. It has long been known that *Boswellia Serrata* resin reduces inflammation, eases pain, and enhances general health and wellbeing ([26]).

The main areas of study on *Boswellia Serrata* have been its analgesic and anti-inflammatory qualities. Research has shown that pro-inflammatory enzymes that contribute to the synthesis of inflammatory mediators, such as cyclooxygenase and 5-lipoxygenase, are inhibited by boswellic acids. *Boswellia Serrata* has the potential to provide relief from inflammatory bowel disease, rheumatoid arthritis, and osteoarthritis by decreasing inflammation ([26,27]).

**Figure 3** *Bosswellia serrata*

- Scientific Classification

**Table 3** Scientific Classification Of *Boswellia Serrata*

| **Rank** | **Scientific Name & Common Name** |
|---|---|
| Biological Name | *Boswellia Serrata* |
| Phylum | Tracheophytes |
| Class | Mangoliopsida |
| Order | Sapindales |
| Family | Burseraceae |
| Genus | *Boswellia* |
| Species | *Boswellia Serrata* |
| Kingdom | Plantae |
| Other Names | Indian frankincense, salai guggul, shallaki |

- Chemical Components
  - Boswellic acids
  - Terpenoids
  - Triterpenes
  - Essential oils
  - Resins
  - Phthalides Steroids
- Medicinal Uses
  - *Boswellia Serrata* has been found to inhibit the production of pro-inflammatory enzymes, such as 5-lipoxygenase (5-LOX)., which play a key role in inflammation. By reducing inflammation, it may help alleviate swelling associated with various conditions (28).
  - The anti-inflammatory effects of *Boswellia Serrata* can also help reduce pain, making it potentially beneficial for conditions characterized by inflammation-induced pain, such as rheumatoid arthritis (29).
  - Studies suggest that *Boswellia Serrata* may be particularly useful in managing symptoms of rheumatoid arthritis. Research has shown that it can help improve joint function and reduce pain and swelling associated with this autoimmune condition (30,31).
  - In addition to rheumatoid arthritis, *Boswellia Serrata* may also be beneficial for osteoarthritis, another common type of arthritis characterized by joint inflammation and degeneration (32,33).

*2.1.4. Geru powder*

Red ochre is a naturally occurring pigment that gets its distinctive red color from iron oxide, usually hematite. Throughout history, it has been employed by many cultures for practical, ceremonial, and artistic purposes. Geological formations frequently contain red ochre, which is frequently connected to deposits and minerals that are high in iron ([34].

Red ochre was a common pigment used by early people for body ornamentation, rock art, and cave paintings. Its use in ceremonies, funeral customs, and as money or a trading good gave it meaning that went beyond just creative expression. Red ochre has been researched for possible medical benefits in addition to its cultural and artistic importance. It may have potential uses as well as antimicrobial and wound-healing qualities, according to some research ([35].

**Figure 4** Geru powder

- Vernacular Names
  - Geru powder
  - Geroo powder
  - Geru churan
  - Red ochre
  - Hematite powder
- Chemical Components

Geru powder primarily consists of iron oxides, predominantly hematite (Fe2O3).. It may also contain traces of other minerals depending on its source and processing methods. The properties of red ochre, including its color, stability, and texture, are primarily determined by the chemical composition of its main constituents, particularly iron oxide minerals like hematite. These properties have contributed to the diverse historical and contemporary uses of red ochre in art, decoration, medicine, and material science ([36].

- Medical uses
  - Geru Powder has astringent, anti-phlegmatic, anti-bilious, and cooling properties. It is effective in providing relief in skin illnesses, piles, bleeding disorders, ulcers, boils, urticaria, vomiting, hiccups, and other conditions (37).
  - Swelling Reduction: Ochre powder contains iron oxide, which has astringent properties. Astringents can cause the contraction of tissues, potentially leading to reduced swelling by constricting blood vessels and minimizing fluid buildup in the affected area.
  - Pain Relief: Ochre powder's potential for pain relief could stem from its astringent properties, which may help to tighten and soothe tissues.
  - Anti-inflammatory : Ochre powder's effectiveness as a direct anti-inflammatory agent is uncertain and may not be as potent as medications or herbal remedies with well-established anti-inflammatory properties (37,38).
  - Antibacterial Poultice: Poultices made from ochre powder mixed with other natural substances have been used to draw out infections from wounds and promote healing, attributed to its antibacterial properties.
  - Antifungal Treatment: Ochre powder has been used externally to treat fungal infections such as athlete's foot and ringworm due to its drying and antifungal properties (39).

*2.1.5. Camphor*

Camphor is a white, translucent, or waxy substance that is made from the wood of the Camphor tree (*Cinnamomum camphora*). or can be artificially produced from turpentine oil. When applied topically, it gives out a rich, aromatic scent and feels refreshing. Since ancient times, camphor has been a part of many cultural and religious rituals as well as conventional medicine.

**Figure 5** A core powder of Camphor

- Scientific Classification

**Table 4** Scientific Classification Of *Cinnamomum camphora*

| **Rank** | **Scientific Name & Common Name** |
|---|---|
| Biological Name | *Cinnamomum camphora* |
| Phylum | Angiosperms |
| Class | Eudicots |
| Order | Laurales |
| Family | Lauraceae |
| Genus | Cinnamomum |
| Species | *Cinnamomum camphora* |
| Kingdom | Plantae |
| Other Name | Camphor tree, Camphorwood or Camphor laurel. |

- Chemical Components
  - Camphor
  - Terpenes
  - Safrole
  - Eugenol
  - Menthol
- Medicinal Uses
  - Topical Analgesic: Camphor is commonly used topically as a pain reliever for minor aches and pains, such as muscle and joint pain, arthritis, and backaches. It produces a cooling sensation on the skin and can help alleviate discomfort (40).
  - Respiratory Relief: Inhalation of camphor vapors or using camphor-based chest rubs can help relieve congestion and cough associated with respiratory conditions like the common cold, bronchitis, or sinusitis. It acts as a decongestant and expectorant, helping to loosen phlegm and ease breathing (41).
  - Anti-inflammatory: Camphor possesses mild anti-inflammatory properties, making it useful for reducing inflammation and swelling associated with conditions like insect bites, minor burns, and dermatitis. It can help soothe irritated skin and promote healing (42).
  - Swelling Reduction: When applied topically, camphor can help alleviate swelling by constricting blood vessels and reducing fluid accumulation in the affected area (43).
  - Pain Relief: Camphor is commonly used as a topical analgesic to provide relief from various types of pain, including muscle aches, joint pain, and arthritis (44).
  - Muscle Relaxant: Camphor oil is often used in massage therapy to help relax muscles and relieve tension. It can be beneficial for sore muscles, muscle cramps, and spasms, promoting relaxation and improving flexibility
  - Antipruritic: Due to its cooling and soothing effects, camphor is used to relieve itching and irritation caused by insect bites, rashes, and allergic reactions. It can provide temporary relief from itching and discomfort (45).
  - Antimicrobial: Camphor has antimicrobial properties that can help inhibit the growth of bacteria, fungi, and viruses. It is sometimes used as an ingredient in topical antiseptic preparations to prevent infection in minor cuts, scrapes, and wounds (42).
  - Nerve Pain Relief: Camphor's cooling and numbing effects make it useful for alleviating nerve pain, such as neuropathic pain or neuralgia. It can provide temporary relief from shooting or burning sensations associated with nerve disorders (44,45).

*2.1.6. Shirish Powder*

The bark of the shirish tree (*Albizia lebbeck*)., commonly referred to as the Indian walnut or Siris tree, is used to make shirish powder. The Indian subcontinent and other regions of Southeast Asia are home to the tree. The shirish tree's bark is ground into a fine powder after drying and grinding. Shirish powder is prized for its therapeutic qualities in ancient Ayurvedic medicine, where it has been used for millennia to cure a wide range of illnesses. It is thought to possess antipyretic, analgesic, astringent, and anti-inflammatory qualities. Shirish powder is widely utilized for its medicinal properties both topically and orally ([46]).

**Figure 6** Shirish

- Scientific Classification

**Table 5** Scientific Classification Of *Albizia lebbeck*

| **Rank** | **Scientific name & Common name** |
|---|---|
| Biological Name | *Albizia lebbeck* |
| Phylum | Spermatophyta |
| Class | Dicotyledonae |
| Order | Fabales |
| Family | Fabaceae |
| Genus | Albizia |
| Species | *Albizia lebbeck* |
| Kingdom | Plantae |
| Other Name | Siris, Indian siris, East Indian walnut, Broome raintree, lebbeck, lebbek tree, frywood, koko and woman's tongue tree. |

- Chemical Components

Lebbeck has been demonstrated to contain various phytochemical constituents, which have demonstrated antiviral activities against different viruses.

  - Flavonoids
  - Saponins
  - Alkaloids
  - Triterpenoids
- Medical uses
  - Antioxidant: Siris contains compounds that exhibit antioxidant activity, helping to neutralize harmful free radicals in the body, thus potentially reducing oxidative stress and preventing cellular damage (47,48).
  - Anti-inflammatory: It is believed that certain components of siris possess anti-inflammatory properties, which may help alleviate inflammation and related conditions such as arthritis and inflammatory skin conditions (49,50).
  - Swelling Reduction: Shirish powder has anti-inflammatory properties that make it beneficial for reducing swelling associated with various conditions such as arthritis, sprains, and minor injuries.
  - Pain Relief: By modulating pain receptors and reducing inflammation, Shirish powder can offer significant pain relief. It can help alleviate both acute and chronic pain, including joint pain, muscle soreness, and headaches (49,50,51).
  - Antimicrobial: Siris has been studied for its antimicrobial properties, suggesting it may have the ability to inhibit the growth of various microorganisms including bacteria and fungi. This property could be useful in treating infections (47,57).
  - Antipyretic: Traditional uses of siris include treating fevers. It is believed to have antipyretic properties, which may help reduce body temperature during fever episodes (52).
  - Analgesic: Siris extracts have been explored for their potential analgesic properties, which could make them useful in managing pain (52, 53).
  - Anti-asthmatic: In traditional medicine systems, siris has been used to alleviate symptoms of respiratory conditions such as asthma. Some studies suggest that it may possess bronchodilator properties, helping to widen the airways and improve breathing (54).

## 3. Material and method


**Figure 7** Materials used in the herbal lep formulation

### 3.1. Materials

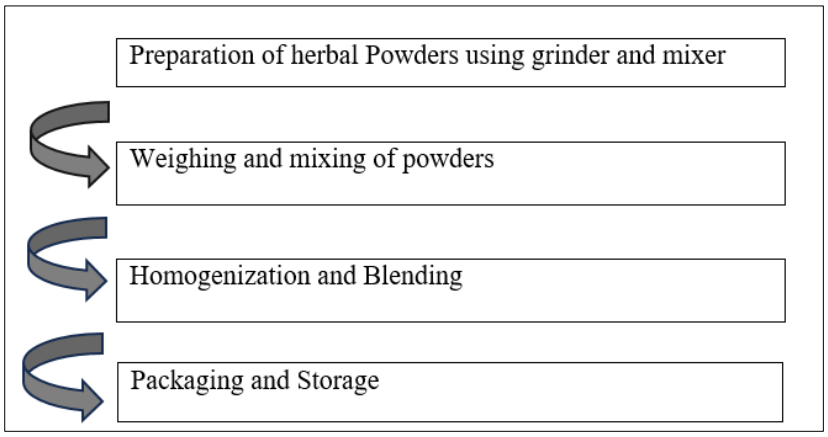
- *Pergularia daemia* (Erukku). powder
- *Boswellia Serrata* (Indian Frankincense). powder
- Ambehaldi (Curcuma aromatica). powder
- Shirish (*Albizia lebbeck*). powder
- Camphor powder
- Geru (Red Ochre). powder
- Mixing bowl(s). and spoon(s).
- Mortar and pestle or grinder
- Weighing balance
- Sieve
- Airtight containers for storage

### 3.2. Method

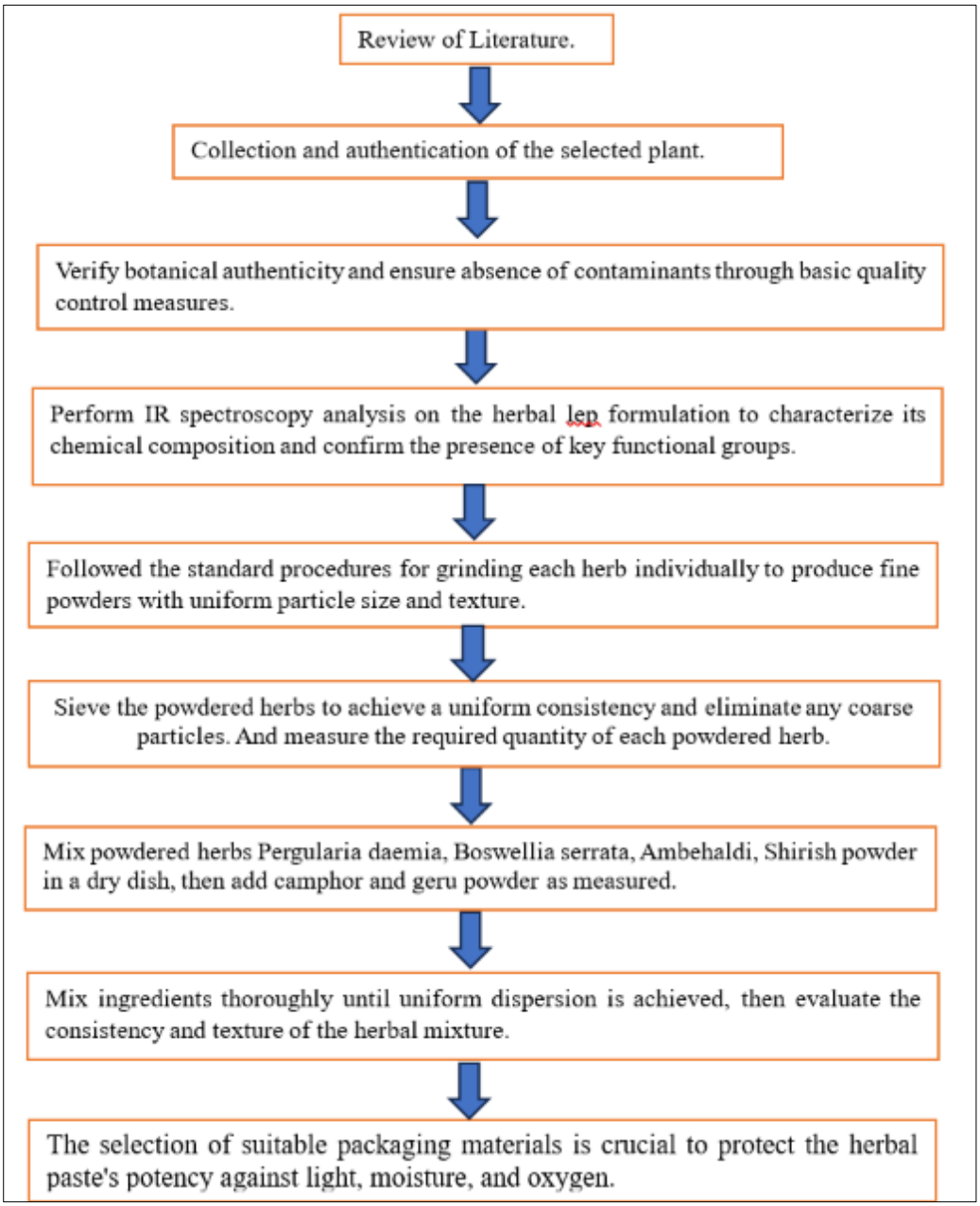
*3.2.1. Collection And Authentification:*

The fresh leaves of *Pergularia daemia* (Forsk). belonging to Asclepiadaceae family were collected from the village side area near to the Khamgaon (April 2024). which are identified and authenticate by **SR. PROFESSOR AND HEAD DR. ARVIND S. DHABE Herbarium In-Charge, B. A. M. U. Herbarium.** And the various plant materials (high quality herbal Powders). used in the formulation were purchased from the reputable suppliers

### 3.3. Steps involve in preparation of herbal lep (powders).




### 3.4. Plan of work



## 4. Phytochemical screening

**Figure 8** Phytochemical Analysis

### 4.1. Alkaloids

Test: Dragendorff's test

Procedure: To 2 ml of extract, few drops of Dragendorff's reagent were added . Formation of an orange or reddish-brown precipitate indicates the presence of alkaloids.

### 4.2. Flavonoids

Test: Shinoda test

Procedure: The extract was treated with concentrated hydrochloric acid, followed by addition of magnesium turnings. Formation of red coloration indicates the presence of flavonoids.

### 4.3. Tannins

Test: Ferric chloride test

Procedure: Few drops of ferric chloride solution were added to the extract. Formation of a blue- black or greenish-black colour indicates the presence of tannins.

### 4.4. Saponins

Test: Froth test

Procedure: Shake the extract vigorously with water. Formation of a stable froth indicates the presence of saponins.

### 4.5. Phenols

Test: Ferric chloride test

Procedure: Few drops of ferric chloride solution were added to the extract. Formation of a bluish or greenish coloration indicates the presence of phenols.

### 4.6. Terpenoids

Test: Salkowski test

Procedure: Mix the extract with chloroform and sulfuric acid. Formation of a reddish- brown coloration at the interface indicates the presence of terpenoids

### 4.7. Glycosides

Test: Legal test

Procedure: Treat the extract with dilute hydrochloric acid, followed by addition of ferric chloride solution. Formation of a blue or green coloration indicates the presence of glycosides.

### 4.8. Steroids

Test: Salkowski test

Procedure: Mix the extract with chloroform and sulfuric acid. Formation of a red coloration in the lower chloroform layer indicates the presence of steroids.

### 4.9. Carbohydrates

Test: Fehling's test

Procedure: Treat the extract with Fehling's solution and heat. Formation of a red ↓ precipitate indicates the presence of reducing sugars.

### 4.10. Proteins and Amino Acids

Test: Biuret test

Procedure: Treat the extract with dilute copper sulphate solution and sodium hydroxide. Formation of a violet coloration indicates the presence of proteins or peptides.

### 4.11. Resins

Test: Solubility test

Procedure: Dissolve the extract in various solvents (e.g., water, ethanol, ether).. Insolubility in water but solubility in organic solvents indicates the presence of resins.

### 4.12. Volatile Oils

Test: Odor test

Procedure: Smell the extract for characteristic aroma, which indicates the presence of volatile oils.

## 5. Evaluation Tests

### 5.1. Physicochemical Analysis

- Particle Size Distribution: Determine the particle size distribution of the herbal lep powders using techniques such as laser diffraction or microscopy.
- Bulk Density: Measure the bulk density of the powders to assess their flow properties and packing characteristics.
- Moisture Content: Determine the moisture content of the powders to ensure stability and prevent microbial growth.
- pH Value: Measure the pH value of the powders to assess their compatibility with skin and mucous membranes.

### 5.2. Microscopic Examination

Microscopic analysis of the herbal lep powders can provide insights into the morphology and uniformity of the particles, as well as the presence of any contaminants or impurities.

#### *5.2.1. Solubility Testing*

Determine the solubility of the herbal lep powders in various solvents, including water, ethanol, and oils, to assess their compatibility with different vehicles and their potential for formulation into topical preparations.

#### *5.2.2. Rheological Analysis*

Perform rheological tests, such as viscosity measurements, to characterize the flow behavior and consistency of the herbal lep formulations, which can influence their spreadability and ease of application.

#### *5.2.3. Skin Irritation Testing*

Perform skin irritation testing using standardized protocols, such as the Draize patch test or in vitro skin irritation assays, to evaluate the potential for skin irritation or sensitization upon topical application of the herbal lep powders.

#### *5.2.4. Stability Testing*

Conduct stability testing under accelerated and long-term storage conditions to assess the physical and chemical stability of the herbal lep powders over time.

## 6. Result and discussion

The preparation of herbal lep powders from various botanical materials was completed, involving sourcing, cleaning, and powdering. The final formulations were then blended in appropriate ratios. The powders were evaluated for their organoleptic properties, including color, Odor, and texture. Visual assessment indicated variations in composition or processing, while qualitative evaluation ensured no unpleasant smells. Tissue examination determined the consistency and feel of the powders. Alkaloids, flavonoids, saponins, tannins, glycosides, and steroids were identified through rigorous testing. Stability testing was conducted to assess shelf-life and storage conditions, exposing the powders to environmental conditions like temperature and humidity over a specified period. This assessment provides valuable information on the formulation's robustness and potential storage requirements. The herbal lep powders underwent microbiological testing to assess their microbial load and safety standards for topical application. The results showed uniformity in particle size distribution and adequate flow characteristics, indicating consistent formulation. These findings suggest that the herbal lep powders may alleviate swelling, pain, and inflammation, indicating their potential for topical use.

## 7. Conclusion

The study successfully formulated a herbal lep utilizing *Pergularia daemia*, red ochre, *Boswellia Serrata*, mango ginger, camphor, and *Albizia lebbeck* for the management of swelling, pain, and inflammation. The results suggest that the combination of these herbs possesses significant health issues involving pain, swelling, and inflammation. This herbal paste offers a holistic approach to wellbeing and may offer relief from illnesses including arthritis, strained muscles, skin irritations, and more thanks to the synergistic effect of its constituent constituents.

The potential effectiveness of the paste is influenced by the natural anti-inflammatory, analgesic, and wound-healing qualities of the botanical ingredients as well as the calming effects of camphor and geru powder. Customization of the formulation further enhances its adaptability and application in a variety of healthcare settings by enabling adaption to individual needs and preferences.

In general, the process of making this herbal paste represents an integrative approach to wellbeing, utilizing nature's healing abilities to ease pain, encourage recovery, and aid in achieving the goal of optimum wellness and vitality.

## Compliance with ethical standards

### *Acknowledgement*

I extend my heartfelt thanks to all my colleagues for their help and co-operation.

### *Disclosure of conflict of interest*

No conflict of interest to be disclosed.

## References


[1] Ghorbani, A (2013).. Studies on pharmaceutical ethnobotany in the region of Turkmen Sahra, north of Iran (Part 1).: general results. Journal of Ethnopharmacology, 147(2)., 512-534.

[2] Bodeker, G., Ong, C. K., Grundy, C., Burford, G., Shein, K., & World Health Organization (2005).. WHO global atlas of traditional, complementary and alternative medicine. World Health Organization.

[3] Ekor, M (2014).. The growing use of herbal medicines: issues relating to adverse reactions and challenges in monitoring safety. Frontiers in Pharmacology, 4, 177.

[4] Al-Duais, M., & Alaraidh, I (2017).. A Review of the Pharmacological Benefits of Various Herbal Plants Extracts on Human Health. Journal of Nutrition and Health Sciences, 4(1)., 104.

[5] Kala, C. P., Dhyani, P. P., & Sajwan, B. S (2006).. Developing the medicinal plants sector in northern India: Challenges and opportunities. Journal of Ethnobiology and Ethnomedicine, 2(1)., 32. [This article discusses the traditional medicinal uses of *Pergularia daemia* and other medicinal plants in northern India.]

[6] Chavan, M. J., Kolhe, D. R., Wakte, P. S., & Shinde, D. B (2012).. Pharmacognostical and pharmacological properties of *Pergularia daemia* (Forsk.).: A review. Asian Pacific Journal of Tropical Biomedicine, 2(10)., S1936-S1939. [This review article provides an overview of the pharmacognostical and pharmacological properties of *Pergularia daemia*, including its traditional uses and potential therapeutic effects.]

[7] Panda, S., Kar, A., & Ganesan, S (2015).. In-vitro and in-vivo anti-inflammatory activity of *Pergularia daemia*. International Journal of PharmTech Research, 7(1)., 184-190. [This research article investigates the anti-inflammatory activity of *Pergularia daemia* using in vitro and in vivo experimental models.]

[8] Vyas, A., & Vyas, M. K (2014).. Anti-inflammatory activity of *Pergularia daemia* root extract and its chemical constituents. International Journal of Pharmacognosy and Phytochemical Research, 6(1)., 63-67. [This study examines the anti-inflammatory activity of *Pergularia daemia* root extract and identifies the chemical constituents responsible for this activity.]

[9] Ahmed, F., Islam, M. A., Rahman, M. M., Islam, M. E., & Mossadik, M. A (2011).. Analgesic, anti-inflammatory and antidiarrheal activities of ethanolic leaf extract of *Pergularia daemia* (Forssk.). Chiov. Journal of Applied Pharmaceutical Science, 1(9)., 126-130. [This research article evaluates the analgesic, anti-inflammatory, and antidiarrheal activities of the ethanolic leaf extract of *Pergularia daemia*.]

[10] Prabhakar, K. R., & Veerapur, V. P (2012).. Antidiabetic activity of *Pergularia daemia* (Forsk.). Chiov. in alloxan induced diabetic rats. Asian Pacific Journal of Tropical Biomedicine, 2(2)., S936–S940. doi:10.1016/S2221-1691(12).60370-9

[11] Kannan, M., & Sivaraj, C (2014).. Phytochemical screening and antimicrobial activity of *Pergularia daemia*. International Journal of Current Microbiology and Applied Sciences, 3(3)., 877-883.

[12] Kumar, A., Singh, S. K., Tripathi, D., & Singh, R. H (2010).. *Pergularia daemia*: A review. Pharmacognosy Reviews, 4(7)., 157–162. doi:10.4103/0973-7847.70907

[13] Hegde K, Joshi AB, Shinde V, et al. Anti-inflammatory and analgesic activities of *Pergularia daemia* (Forsk.).: a promising ethnomedicinal plant. J Ethnopharmacol. 2010;130(3).:465-471. doi:10.1016/j.jep.2010.05.015

[14] Ghosh A, Mandal S, Banerji A, Kar M. Evaluation of anti-inflammatory effect of *Pergularia daemia* (Forsk.). on Wistar albino rats. J Adv Pharm Technol Res. 2010;1(3).:338-341. doi:10.4103/0110-5558.72431

[15] Kumar, D., Bhujbal, S. S., Deoda, R. S., Mali, P. Y., Pawar, M. J., & Habbu, P. V (2013).. Curcuma amada: A review on its phytochemical and pharmacological profile. Journal of Pharmacognosy and Phytochemistry, 2(5)., 116-121.

[16] Haldar, S., & Chaudhuri, R. K (2012).. Review on Curcuma amada Roxb. Pharmacognosy Reviews, 6(11)., 96-100. DOI: 10.4103/0973-7847.99896

[17] Joshi, S., & Pareek, S (2016).. An overview on Curcuma amada Roxb. International Journal of Research in Pharmacy and Pharmaceutical Sciences, 1(1)., 16-20.

[18] Sharma, M., & Kaur, N (2017).. A review on Curcuma amada. International Journal of Green Pharmacy (IJGP)., 11(3)., S549-S552. DOI: 10.22377/ijgp.v11i03.943

[19] Annapurna, J., Sivaprasad, N., Rajanikanth, B., & Chandrasekhar, N (2011).. Phytochemical studies on the rhizomes of Curcuma amada Roxb. International Journal of Pharmacy and Pharmaceutical Sciences, 3(3)., 199-201.

[20] The Agronomy and Economy of Turmeric and Ginger: The Invaluable Medicinal Spice Crops. Newnes. pp. 7–10. ISBN 9780123948243.

[21] "Turmeric". National Center for Complementary and Integrative Health, US National Institutes of Health. May 2020. Retrieved 25 November 2020.

[22] Policegoudra RS, Abiraj K, Channe Gowda D and Aradhya SM 2007b Isolation and characterization of antioxidant and antibacterial compound from mango ginger (Curcuma amada Roxb.). rhizome. J. Chromatogr. B 852 40–48

[23] Srivastava S, Srivastava M, Rawat AKS and Mehrotra S 2006 Pharmacognostic evaluation of *Curcuma amada* Roxb. Proc. Nat. Acad. Sci. Ind. 76 153–160

[24] Sivakumar, V., Dey, A., Nair, R., Prathapan, A., & Pushpangadan, P (2010).. Zingiberaceous plants and their vernacular uses in Kerala. Journal of Tropical Agriculture, 48(1-2)., 23-26.

[25] Gupta, I., Parihar, A., Malhotra, P., Gupta, S., Ludtke, R., Safayhi, H., ... & Srimal, R. C (1997).. Effects of *Boswellia Serrata* gum resin in patients with ulcerative colitis. European Journal of Medical Research, 2(1)., 37-43.

[26] Ammon, H. P. T (2010).. Boswellic acids and their role in chronic inflammatory diseases. Advances in Experimental Medicine and Biology, 928, 291–327. DOI: 10.1007/978-90-481-3296-6_13

[27] Poeckel, D., & Werz, O (2006).. Boswellic acids: biological actions and molecular targets. Current Medicinal Chemistry, 13(28)., 3359–3369. DOI: 10.2174/092986706778201732

[28] Sharma S, Thawani V, Hingorani L. Pharmacokinetic study of 11-ketobeta-boswellic acid. Phytomedicine 2004;11:255-60

[29] El-Khadem H, El-Shafei ZM, Elsekeify MA, Abdel Rahman MM. Derivatives of boswellic acids. Planta Med 1972;22:157-9.

[30] Etzel, R. "Special extract of *Boswellia Serrata* (H 15). in the treatment of rheumatoid arthritis." Phytomedicine 3.1 (1996).: 91-94.

[31] Ammon, H. P. T (2016).. Boswellic Acids in Chronic Inflammatory Diseases. Planta Medica, 82(09/10)., 676–685. [DOI: 10.1055/s-0042-110077]

[32] Sharma, M. L., & Bani, S (2011).. Pharmacological properties of Boswellic acids, potential agents for chronic diseases. Indian Journal of Experimental Biology, 49(5)., 321–332. [PMID: 21627086]

[33] Wadley, L (2001).. What is cultural modernity? A general view and a South African perspective from Rose Cottage Cave. Cambridge Archaeological Journal, 11(2)., 201–221. DOI: 10.1017/S0959774301000110

[34] Aubert, M., & Brumm, A (2016).. The archaeology of rock-art in Western Arnhem Land, Australia: A revised chronology from the northern Kakadu sandstone plateau. Journal of Archaeological Science: Reports, 6, 782–800. DOI: 10.1016/j.jasrep.2016.01.016

[35] Wadley, L (2015).. Those marvellous millennia: The Middle Stone Age of Southern Africa. Azania: Archaeological Research in Africa, 50(2)., 155–226. [DOI: 10.1080/0067270X.2015.1059986]

[36] Duarte, C. M (2014).. Red ochre and shells: clues to human evolution. Trends Ecol. Evol. 29, 560–565. doi:10.1016/j.tree.2014.08.002

[37] Kotagasti, T (2015).. Efficacy of Geru (red ochre). in controlling the bleeding in patients of Adolescent menorrhagia. CellMed 5, 12.1–12.3. doi:10.5667/tang.2015.0002

[38] Li, W., Bao, Y., Liu, H., & Liu, C (2019).. The antibacterial activity and mechanism of action of red ochre against Staphylococcus aureus. RSC Advances, 9(8)., 4420–4429. DOI: 10.1039/C8RA09073K

[39] Zaveri, M., & Khandhar, A (2013).. Camphor. In L. J. J. Nenadis (Ed.)., Handbook of Analysis of Active Compounds in Functional Foods (pp. 311–322).. CRC Press. [DOI: 10.1201/b14139-26]

[40] Turner, R. B (2010).. The Role of Antimicrobial Agents in the Treatment and Prevention of Upper Respiratory Tract Infections. In J. W. Albrecht, J. C. Norman, & G. H. Cassileth (Eds.)., Integrative Medicine (pp. 237–247).. Springer. [DOI: 10.1007/978-1-4419-1333-8_17]

[41] Sherkheli Muhammad Azhar, Benecke Heike, Doerner Julia Franca, Kletke Olaf, VogtEisele A.K., Gisselmann Guenter, et al. Monoterpenoids Induce Agonist Specific Desensitization of Transient Receptor Potential Vanilloid-3 Ion Channels. J. Pharm. Pharmaceut. Sci. 12.1 2009:1162

[42] Doss, M., & Dhanabalan, R (2013).. A review on ethnobotanical, phytochemical and pharmacological properties of *Cinnamomum camphora* L. Journal of Acute Medicine, 3(3)., 85–91. DOI: 10.1016/j.jacme.2013.05.005

[43] JaraOseguera Andres, Simon Sidney A., Rosenbaum Tamara. TRPV1: On the Road to Pain Relief. National Institutes of Health 2008;1(3).:2556

[44] Goyal, Amit, et al. "Chemical Stability and Applications of Camphor in Pharmaceutical Formulations." International Journal of Pharmaceutical Sciences and Research, vol. 11, no. 5, 2020, pp. 2042-2056.

[45] Dwivedi, S., Dwivedi, M., Malviya, S., Kushwah, P., & Vyas, S (2011).. Traditional Indian Medicines Used for the Management of Diabetes Mellitus. Journal of Diabetes Research, 2011, 1-14. DOI: 10.1155/2011/561625.

[46] De Paula, R. C. M., S. A. Santana, and J. F. Rodrigues. "Composition and rheological properties of *Albizia lebbeck* gum exudate." Carbohydrate polymers 44.2 (2001).: 133-139.

[47] Balkrishna, Acharya, et al. "A Comprehensive Insight into the Phytochemical, Pharmacological Potential, and Traditional Medicinal Uses of *Albizia lebbeck* (L.). Benth." Evidence-Based Complementary and Alternative Medicine 2022 (2022)..

[48] Saha, Achinto, and Muniruddin Ahmed. "The analgesic and anti-inflammatory activities of the extract of *Albizia lebbeck* in animal model." Pakistan journal of pharmaceutical sciences 22.1 (2009)..

[49] Abd El-Ghany, Afaf El-Sayed, et al. "Phytochemical and biological study of *Albizia lebbeck* stem bark." J. Chem. Pharma. Res 7 (2015).: 29-43.

[50] Verma, S. C., et al. "A review on parts of *Albizia lebbeck* (L.). Benth. used as ayurvedic drugs." Research Journal of Pharmacy and Technology 6.11 (2013).: 1307-1313.

[51] Babu, N. Prakash, P. Pandikumar, and S. Ignacimuthu. "Anti-inflammatory activity of *Albizia lebbeck* Benth., an ethnomedicinal plant, in acute and chronic animal models of inflammation." Journal of ethnopharmacology 125.2 (2009).: 356-360.

[52] Tasnim, Jerin, et al. "Biological studies of the bark of *Albizia lebbeck* (L.). Benth." International Journal of Pharmaceutical Sciences and Research 5.11 (2014).: 4969.

[53] O. N. Avoseh, F. M. Mtunzi, I. A. Ogunwande, R. Ascrizzi, and F. Guido, "*Albizia lebbeck* and Albizia zygia volatile oils exhibit anti-nociceptive and anti-inflammatory properties in pain models," Journal of Ethnopharmacology, vol. 268, Article ID 113676, 2021.

[54] S. Mishra, V. Gothecha, A. Sharma (2010).. *Albizia lebbeck*: a short review. Journal of Herbal Medicine and Toxicology. 4(2).: 9-15.