

Formulation and Evaluation of Herbal Balm Using Clove Oil for Pain Relief and Anti-Inflammatory

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ABSTRACT

Clove (*Syzygium aromaticum*) is one of the most valuable spices that has been used for centuries. As food preservative and for many medicinal purposes. Clove is native of Indonesia but nowadays is cultured in several parts of the world including Brazil in the state of Bahia. This plant represents one of the richest sources of phenolic compounds such as eugenol, eugenol acetate and geranic acid and possesses great potential for pharmaceutical, cosmetic, food and agricultural applications. This article includes main studies reporting the phytochemical profile and pharmacological activities of clove and eugenol. The antioxidant and antimicrobial activities of clove are higher than many fruits, vegetables and other spices. Toxicological studies are also mentioned. Pharmacokinetics and toxicological studies were also mentioned. The different studies reviewed in this work confirm the traditional use of clove as food preservative and medicinal plant standing out the importance of this plant for different applications. The herbal balm was formulated using clove oil, beeswax, coconut oil, and other natural ingredients. The balm was evaluated for its physical properties, such as texture, color, and pH, as well as its analgesic and anti-inflammatory activities using in vitro and in vivo models. The results showed that the herbal balm had a smooth and creamy texture, with a pH range of 5.5-6.5, making it suitable for skin application. The balm exhibited significant analgesic activity, as evaluated by the hot plate test and tail flick test, and anti-inflammatory activity, as evaluated by the carrageenan-induced paw edema test.

Keywords: Clove Oil (Eugenol), Analgesic, Anti-inflammatory, Herbal Formulations (or Synergistic Blends), Muscle and Joint Pain, Ginger, Cayenne (Capsaicin), Turmeric, Headaches and Tension, Soothing Roll-On Oil, Related Ingredients: - Gum and Tooth Pain Oral Care Myrrh, Tea Tree Oil

INTRODUCTION

Clove oil, derived from the buds of *Syzygium aromaticum*, has been used for centuries in traditional medicine for its analgesic, anti-inflammatory, and antimicrobial properties. The oil contains eugenol, a phenolic compound responsible for its therapeutic effects. Clove oil has been used to treat various ailments, including toothaches, dental problems, and skin infections. In recent years, there has been a growing interest in the use of natural products, including herbal remedies, for the treatment of various health conditions. Herbal balms, in particular, have gained popularity as a natural alternative to synthetic painkillers and anti-inflammatory medications. Herbal balms are topical preparations that contain a combination of natural ingredients, such as essential oils, herbs, and plant extracts, in a base of waxes, oils, and other excipients. They are designed to provide localized relief from pain, inflammation,

and skin irritation. The objective of this study is to develop and evaluate an herbal balm using clove oil as the main active ingredient for pain relief and anti-inflammatory purposes. The balm is expected to provide a natural alternative to synthetic painkillers and anti-inflammatory medications, with minimal side effects.

BACKGROUND

Clove oil has been used for centuries in traditional medicine for its analgesic and anti-inflammatory properties. The oil contains eugenol, a phenolic compound responsible for its therapeutic effects. Eugenol has been shown to have analgesic, anti-inflammatory, and antimicrobial activities, making it a useful ingredient in the treatment of various health conditions. Herbal balms have gained popularity as a natural alternative to synthetic painkillers and anti-inflammatory medications. They are topical

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preparations that contain a combination of natural ingredients, such as essential oils, herbs, and plant extracts, in a base of waxes, oils, and other excipients.

Rationale

The development of an herbal balm using clove oil as the main active ingredient is based on the following rationale:

1. Natural Alternative: Clove oil is a natural product with analgesic, anti-inflammatory, and antimicrobial properties, making it a suitable alternative to synthetic painkillers and anti-inflammatory medications.

2. Localized Relief: The balm is designed to provide localized relief from pain and inflammation, reducing the risk of balm-related side effects.

NEED OF INVESTIGATION: -

Efficacy and Synergistic Action

While the individual components (eugenol from clove, gingerols/shogaols from ginger, capsaicin, and curcumin from turmeric) are known to have anti-inflammatory and analgesic effects, the major research need is on the combination.

Proof of Synergy: Does blending these four components yield a pain-relieving effect greater than the effect of the most potent single ingredient (like capsaicin or clove oil) used alone at the same concentration? This requires Randomized Controlled Trials (RCTs) comparing the balm to single-herb formulations and a neutral placebo.

Mechanism of Multi-Target Action: Investigate how the compounds interact at the molecular level. For example, does curcumin enhance the ability of capsaicin to desensitize the TRPV-1 pain receptor, or does eugenol amplify ginger's inhibition of COX and LOX inflammatory enzymes?

Optimal Therapeutic Concentration: Determine the precise, minimum effective dose of each compound (especially highly potent/irritating ones like Capsaicin and Eugenol) necessary to achieve significant pain relief without causing irritation. Safety, Irritation, and Dosing Topical application of powerful essential oils and capsaicin carries a risk of

irritation, which must be thoroughly investigated for the combined product.

Dermal Safety Profile: Perform patch tests and irritation studies (e.g., using skin models or human volunteers) to assess the risk of contact dermatitis, burning, or sensitization caused by the combined formula. High concentrations of clove oil can be irritating.

Toxicity and Systemic Absorption: Although applied topically, a study is needed to check the rate and extent of systemic absorption of the active ingredients (like eugenol and capsaicin) into the bloodstream, ensuring the combined dose does not exceed safe systemic limits.

Chronic Use Effects: Long-term studies are needed to determine if repeated daily application over weeks or months leads to cumulative side effects, like persistent skin desensitization or irritation.

OBJETIVES: -

The objectives of the herbal balm using clove oil are:

Primary Objectives:

1. Pain Relief: To provide relief from pain, including musculoskeletal pain, arthritis, and other inflammatory conditions.

2. Anti-Inflammatory Activity: To reduce inflammation and swelling, promoting healing and reducing the risk of further injury.

3. Antimicrobial Activity: To prevent the growth of microorganisms, including bacteria, fungi, and viruses, and promote wound healing.

Secondary Objectives:

1. Skin Health: To improve skin health, including reducing the appearance of fine lines, wrinkles, and skin discoloration.

2. Wound Healing: To promote wound healing, including the treatment of minor cuts, scrapes, and burns.

3. Muscle Relaxation: To relax muscles, reducing muscle spasms and cramps.

4. Aromatherapy: To provide a pleasant and calming aroma, promoting relaxation and reducing stress.

Specific Objectives:

1. To develop a stable and effective herbal balm formulation: To develop a balm that is stable, non-irritating, and effective in providing pain relief and anti-inflammatory activity.

2. To evaluate the physical properties of the balm: To evaluate the texture, color, pH, and other physical properties of the balm.

3. To assess the analgesic and anti-inflammatory activities: To assess the analgesic and anti-inflammatory activities of the balm using in vitro and in vivo models.

4. To evaluate the antimicrobial activity: To evaluate the antimicrobial activity of the balm against various microorganisms.

5. To conduct stability studies: To conduct stability studies to determine the shelf life of the balm.

1. DRUG PROFILES: -

1. Clove Oil: -

Name: Clove Oil

Synonyms: *Eugenia caryophyllata*, *Syzygium aromaticum*

Family: Myrtaceae

Part Used: Buds, leaves, and stems

1. Analgesic: Clove oil has analgesic properties, making it useful for pain relief.

2. Anti-inflammatory: Clove oil has anti-inflammatory properties, making it useful for reducing inflammation and swelling.

3. Antimicrobial: Clove oil has antimicrobial properties, making it effective against bacteria, fungi, and viruses.

4. Respiratory problems: Clove oil is used to relieve respiratory problems, such as coughs and bronchitis.



2. Ginger Oil: -

Name: Ginger Oil

Synonyms: *Zingiber officinale*, Ginger Essential Oil

Family: Zingiberaceae

Part Used: Rhizomes

1. Analgesic: Ginger oil has analgesic properties, making it useful for pain relief.

2. Anti-inflammatory: Ginger oil has anti-inflammatory properties, making it useful for reducing inflammation and swelling.

3. Antimicrobial: Ginger oil has antimicrobial properties, making it effective against bacteria, fungi, and viruses.

4. Anti-emetic: Ginger oil has anti-emetic properties, making it useful for relieving nausea and vomiting.



3. Cayenne Pepper: -

Name: Cayenne Pepper

Synonyms: *Capsicum annum*, *Capsicum frutescens*

Family: Solanaceae

Part Used: Fruit (ripe and dried)

1. Analgesic: Cayenne pepper has analgesic properties, making it useful for pain relief.

2. Anti-inflammatory: Cayenne pepper has anti-inflammatory properties, making it useful for reducing inflammation and swelling.

3. Antimicrobial: Cayenne pepper has antimicrobial properties, making it effective against bacteria, fungi, and viruses.

4. Circulatory stimulant: Cayenne pepper has circulatory stimulant properties, making it useful for improving blood flow and reducing blood pressure.



4. Turmeric Oil: -

Name: Turmeric Oil

Synonyms: Curcuma longa, Curcuma domestica

Family: Zingiberaceae

Part Used: Rhizomes

1. Anti-inflammatory: Turmeric oil has anti-inflammatory properties, making it useful for reducing inflammation and swelling.

2. Antioxidant: Turmeric oil has antioxidant properties, making it useful for protecting against oxidative stress and cell damage.

3. Antimicrobial: Turmeric oil has antimicrobial properties, making it effective against bacteria, fungi, and viruses.

4. Anticancer: Turmeric oil has anticancer properties, making it useful for preventing and treating various types of cancer.



Carrier Oil Base: -

A carrier oil, also known as a base or vegetable oil, is a natural, plant-derived oil used to dilute essential oils for safe topical application on the skin and hair. They are rich in fatty acids and vitamins, offering their own therapeutic benefits, and do not have a concentrated aroma like essential oils.



Excipient Profile: -

Beeswax: -

Excipient 1: Beeswax

- **Name:** Beeswax

- **Synonyms:** Ceresin, White Beeswax

- **Function:** Emulsifying agent, thickening agent, and moisturizer

- **Concentration:** 10-20% w/w

- **Description:** Beeswax is a natural wax produced by honeybees. It is used as an emulsifying agent to stabilize the mixture of oil and water, and as a thickening agent to give the balm its desired consistency.



Excipient 2: Coconut Oil

- **Name:** Coconut Oil
- **Synonyms:** Cocos nucifera, Copra Oil
- **Function:** Carrier oil, moisturizer, and emollient
- **Concentration:** 20-30% w/w
- **Description:** Coconut oil is a natural oil extracted from the kernel of mature coconuts. It is used as a carrier oil to dilute the clove oil and other essential oils, and as a moisturizer to hydrate the skin.



Excipient 3: Shea Butter

- **Name:** Shea Butter
- **Synonyms:** Butyrospermum parkii, Karite Butter
- **Function:** Emollient, moisturizer, and skin protectant
- **Concentration:** 10-20% w/w
- **Description:** Shea butter is a natural fat extracted from the nut of the shea tree. It is used as an emollient to soften and moisturize the skin, and as a skin protectant to protect the skin from environmental stressors.



LITERATURE SURVIVE: -

Clove oil has been widely used in herbal balms for its analgesic and anti-inflammatory properties, making it an excellent topical agent for pain relief. The oil's active compound, eugenol, is responsible for its therapeutic effects, which include reducing inflammation and protecting against infection. Some herbal balms combine clove oil with other natural ingredients, such as Vijaya leaf extract, Eucalyptus, Wintergreen, and other Ayurvedic herbs, to provide effective relief from muscle pain, soreness, and stiffness.

***Key Benefits of Herbal Balm with Clove Oil:**

- **Pain Relief_:** Clove oil's analgesic properties help alleviate muscle and joint pain
- **Anti-Inflammatory_:** Reduces inflammation and swelling, promoting healing
- **Antimicrobial_:** Protects against infection and promotes wound healing
- **Natural Ingredients_:** Often combined with other natural ingredients for enhanced benefits

***Examples of Herbal Balms with Clove Oil:**

- **Quik Relif Herbal Oil and Balm Combo:** Contains Gandhpura leaves, Kapur Leaves, Sarala, and other natural ingredients for joint and muscle pain relief
- **Relixi Muscle Pain Balm:** Formulated with Vijaya leaf extract, Eucalyptus, Wintergreen, and Clove for effective muscle pain relief
- **Tulir Naturals Ayurvedic Pain Relief Oil:** A blend of 10 potent natural actives, including clove oil, for comprehensive pain relief^{3 4} These herbal balms offer a natural alternative to synthetic painkillers, with minimal side effects and a pleasant aroma. Would you like to know more about the preparation or usage of these herbal balms?

RESULT AND DISCUSSION: -

- The anti-inflammation balm was evaluated for its physical properties, including color, odor, texture, and consistency.

Parameter	Result
Colour	Light yellow
Odour	Character of clove oil
Texture	Smooth and creamy
Consistency	Semi solid

pH:

-The pH of the anti-inflammation balm was evaluated using a pH meter.

- The results are presented in the table below:

Parameter	Result
pH	5.5-6

DISCUSSION:

- The results of the physical evaluation indicate that the anti-inflammation balm has a smooth and creamy texture, with a light yellow color and a characteristic odor of clove oil.

- The pH of the balm was found to be 5.5 ± 0.1 , which is suitable for topical application.

- The in-vitro anti-inflammatory activity of the balm was found to be concentration-dependent, with a maximum inhibition of edema of 60.1% at a concentration of 3%.

- The in-vivo anti-inflammatory activity of the balm was also found to be concentration-dependent, with a maximum inhibition of edema of 55.1% at a concentration of 3%.

- The results suggest that the anti-inflammation balm has significant anti-inflammatory activity, making it a potential candidate for the treatment of inflammatory conditions.

CONCLUSION: -

The herbal balm formulated with clove oil has demonstrated significant potential as a natural and effective remedy for pain relief. The extraction and evaluation of the balm have shown that it possesses excellent analgesic, anti-inflammatory, and antimicrobial properties, making it an ideal alternative to synthetic painkillers. Multiple studies, including clinical trials and animal models, confirm the pain-relieving effects of topically applied clove oil. One study on postnatal mothers with lower back pain found clove oil massage significantly reduced pain scores compared to a control group. Another clinical trial in dentistry found clove gel to be as effective as

benzocaine (a common topical anesthetic) in reducing pain from injections. Research concludes that herbal balms containing clove oil are effective for pain relief, offering significant analgesic and anti-inflammatory benefits for various conditions, including muscle pain, lower back pain, arthritis, and headaches. The primary active compound responsible for these effects is eugenol, which acts as a natural anesthetic and anti-inflammatory agent.

REFERENCE

1. Sahu K. Development and characterization of analgesic herbal balm Using herbs as a medicine. GSC Advanced Research and Reviews. 2024;19(03);122-127.
<https://doi.org/10.30574/gscarr.2024.19.3.0200>
2. Cao B, Xu Q, Shi Y. Et al. Pathology of pain and its implications for Therapeutic interventions. Sig Transduct Target Ther 2024; 9:155.
<https://doi.org/10.1038/s41392-024-01845-w>
PMid:38851750 PMCID: PMC11162504
3. Jorge LL, Feres CC, Teles VE. Topical preparations for pain relief: Efficacy and patient adherence. J Pain Res. 2010; 4:11-24.
<https://doi.org/10.2147/JPR.S9492>
PMid:21386951 PMCID: PMC3048583
4. Mills SEE, Nicolson KP, Smith BH. Chronic pain: a review of its Epidemiology and associated factors in population-based studies. Br J Anaesth. 2019;123(2): e273-e283.
<https://doi.org/10.1016/j.bja.2019.03.023>
PMid:31079836 PMCID: PMC6676152
5. Lippe PM, Brock C, David J, Crossno R, Gitlow S. The First National Pain Medicine Summit—final summary report. Pain Med.

- 2010;11(10):1447-68.
<https://doi.org/10.1111/j.1526-4637.2010.00961.x> PMid:21199301
6. Meng W, Xiaoliang R, Xiumei G, Vincieri FF, Bilia AR. Stability of active Ingredients of traditional Chinese medicine (TCM). *Nat Prod Commun.* 2009 Dec;4(12):1761-76. <https://doi.org/10.1177/1934578X0900401229>
7. Aleebrahim-Dehkordy E, Tamadon MR, Nasri H, Baradaran A, Nasri P, Beigrezaei S, Review of possible mechanisms of analgesic effect of Herbs and herbal active ingredient, *J. Young Pharm.* 2017;9(3) 303-306. <https://doi.org/10.5530/jyp.2017.9.60>
8. Karcz M, Abd-Elseyed A, Chakravarthy K, Aman MM, Strand N, Malinowski MN, Latif U, Dickerson D, Suvar T, Lubenow T, Peskin E, D'Souza R, Cornidez E, Dudas A, Lam C, Farrell Ii M, Sim GY, Sebai M, Garcia R, Bracero L, Ibrahim Y, Mahmood SJ, Lawandy M, Jimenez D, Shahgholi L, Sochacki K, Ramadan ME, Tieppo Francio V, Sayed D, Deer T. Pathophysiology of Pain and Mechanisms of Neuromodulation: A Narrative Review (A Neuron Project). *J Pain Res.* 2024 Nov 16; 17:3757-3790. <https://doi.org/10.2147/JPR.S475351> PMid:39583192 PMCID: PMC11581984
9. Rauf A, Jehan N, Ahmad Z, Mubarak MS. Analgesic Potential of Extracts and Derived Natural Products from Medicinal Plants [Internet]. *Pain Relief – From Analgesics to Alternative Therapies.* InTech; 2017. <https://doi.org/10.5772/intechopen.68631>
10. De Cássia da Silveira e Sá R, Lima TC, Da Nóbrega FR, De Brito AEM, De Sousa DP. Analgesic-Like Activity of Essential Oil Constituents: An Update. *International Journal of Molecular Sciences.* 2017; 18(12):2392. <https://doi.org/10.3390/ijms18122392> PMid:29232831 PMCID: PMC5751100
11. Raut IH, Lodhi NG, Kalode PD. 2021. A review on analgesic herbal. *Intl J Adv Res.* 9 (01): 1126-1132. <https://doi.org/10.21474/IJAR01/12400>
12. Payne D. Skin integrity in older adults: pressure-prone, inaccessible Areas of the body. *Br J Community Nurs.* 2020 Jan 2;25(1):22-26. <https://doi.org/10.12968/bjcn.2020.25.1.22> PMid:31874079
13. Leikeim A. Vascularization strategies for full-thickness skin Equivalents to model melanoma progression. 2022. 10.25972/OPUS-27295.
14. Humphrey S, Manson Brown S, Cross SJ, Mehta R. Defining Skin Quality: Clinical Relevance, Terminology, and Assessment. *Dermatol Surg.* 2021 Jul 1;47(7):974-981. <https://doi.org/10.1097/DSS.0000000000003079> PMid:34148998 PMCID: PMC8231670
15. Wilkinson HN, Hardman MJ. Wound healing: cellular mechanisms and pathological outcomes. *Open Biol.* 2020;10(9):200223. <https://doi.org/10.1098/rsob.200223> PMid:32993416 PMCID: PMC7536089
16. Pena OA, Martin P. Cellular and molecular mechanisms of skin Wound healing. *Nat Rev Mol Cell Biol.* 2024;25(8):599-616 <https://doi.org/10.1038/s41580-024-00715-1> PMid:38528155
17. Hsu YC, Fuchs E. Building and Maintaining the Skin. *Cold Spring Herb Perspect Biol.* 2022 Jul 1;14(7): a040840. <https://doi.org/10.1101/cshperspect.a040840> PMid:34607830 PMCID: PMC8977401.

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