

Formulation And Evaluation of Herbal Pain Relief Balm Using Clove and Eucalyptus Oil

Shivam Jayprakash Yadav¹, Amit Kumar Vishwakarma², Yadav Vikas Rajmani³, Ruchi Jain⁴, Sumit Chaurasiya⁵, Abhishek Banke⁶, R. B. Goswami⁷

^{1,2,3,4,5,6,7} *Sagar Institute of Research Technology & Science-Pharmacy, Bhopal*

Abstract—Herbal formulations have gained significant attention due to their therapeutic effectiveness, safety, and minimal side effects compared to synthetic products. The present study focuses on the formulation and evaluation of an herbal pain relief balm containing clove oil and eucalyptus oil as major active ingredients. Clove oil possesses analgesic, anti-inflammatory, and antimicrobial properties due to the presence of eugenol, while eucalyptus oil provides cooling, soothing, and pain-relieving effects. The herbal balm was prepared using natural ingredients such as beeswax, menthol, camphor, and petroleum jelly as the base. The formulation was evaluated for various physicochemical parameters including appearance, color, odor, consistency, pH, spreadability, washability, homogeneity, and stability. The prepared balm showed good consistency, smooth texture, satisfactory spreadability, and stability under different storage conditions. The formulation also demonstrated effective soothing and pain-relieving action when applied topically. The study concludes that the developed herbal pain relief balm is safe, effective, and suitable for the management of muscular pain, headache, and minor body aches, thereby offering a natural alternative to conventional synthetic pain relief products.

I. INTRODUCTION

Pain is one of the most common health problems affecting people of all age groups and may arise due to inflammation, muscle strain, headache, arthritis, or minor injuries. Conventional pain relief products available in the market often contain synthetic chemicals that may produce side effects such as skin irritation, allergies, or long-term toxicity after prolonged use. Therefore, there is an increasing demand for herbal formulations because of their natural origin, safety, effectiveness, and reduced adverse effects.

Herbal balms are semisolid topical preparations

applied externally to relieve pain, inflammation, and discomfort. These formulations generally contain medicinal plant extracts and essential oils possessing analgesic, anti-inflammatory, antimicrobial, and cooling properties. Herbal pain relief balms have gained popularity due to their rapid action, easy application, affordability, and patient compliance.

Among various herbal ingredients, clove oil and eucalyptus oil are widely used for pain management. Clove oil, obtained from the dried flower buds of the clove plant, contains eugenol as its major active constituent, which exhibits significant analgesic, anti-inflammatory, antiseptic, and antioxidant properties. It is traditionally used for relieving toothache, muscular pain, and joint inflammation. Eucalyptus oil, extracted from eucalyptus leaves, possesses cooling, soothing, and decongestant properties. It is commonly used in topical preparations for relieving body pain, headache, muscle stiffness, and respiratory discomfort.

The present study aims to formulate and evaluate a herbal pain relief balm using clove oil and eucalyptus oil as active ingredients. The prepared balm is intended to provide effective pain relief with minimal side effects while utilizing natural and easily available herbal materials. The formulation is evaluated for various physicochemical parameters such as color, odor, consistency, spreadability, homogeneity, washability, pH, and stability to ensure the quality, safety, and effectiveness of the product. The study highlights the potential of herbal ingredients in developing safe and economical alternatives to synthetic pain relief formulations.

II. REVIEW OF LITERATURE

P. M. Davidson and T. M. Taylor discussed the importance of natural antimicrobial compounds as

alternatives to synthetic preservatives in pharmaceutical and healthcare products. The study emphasized that plant-derived essential oils possess strong antimicrobial and preservative properties that can enhance product safety and stability. The authors explained that herbal compounds obtained from medicinal plants show significant activity against various microorganisms while producing fewer side effects. Their work supports the use of natural ingredients such as clove oil and eucalyptus oil in topical herbal formulations including pain relief balms due to their antimicrobial and therapeutic potential.

M. Soković et al. investigated the antibacterial effects of essential oils extracted from medicinal herbs using in vitro techniques. The researchers found that several essential oils demonstrated strong inhibitory effects against pathogenic bacteria and fungi. The study highlighted that essential oils containing phenolic compounds exhibit high antimicrobial efficiency. Clove oil was particularly recognized for its effectiveness because of the presence of eugenol, while eucalyptus oil showed promising antibacterial action. The findings support the use of these oils in herbal balm formulations for providing antimicrobial protection along with pain-relieving effects.

A. Prashar, I. C. Locke, and C. S. Evans evaluated the cytotoxicity of lavender oil and its major components on human skin cells. The study aimed to assess the safety of essential oils when used in topical applications. The authors reported that essential oils can be safely used at controlled concentrations without causing significant skin damage or irritation. Their research provided important information regarding the safe incorporation of herbal oils into topical preparations such as balms, creams, and ointments. The study also emphasized the need for proper formulation techniques to maintain product safety and effectiveness.

R. Ali, M. S. Mirza, and S. A. Ashraf reviewed the role of herbal medicines in healthcare management. The authors explained that herbal formulations have gained popularity worldwide because of their natural origin, low toxicity, affordability, and therapeutic efficacy. The review highlighted the increasing use of medicinal plants in treating pain, inflammation, infections, and skin disorders. The study emphasized

that herbal products containing essential oils and plant extracts can serve as effective alternatives to synthetic drugs. This work strongly supports the development of herbal pain relief balms using natural ingredients such as clove and eucalyptus oil.

S. Burt reviewed the antibacterial properties and applications of essential oils in different fields including healthcare and pharmaceuticals. The study explained that essential oils possess antimicrobial, antioxidant, and anti-inflammatory activities due to the presence of bioactive compounds. The author discussed that clove oil exhibits excellent antibacterial action because of eugenol, while eucalyptus oil provides cooling and soothing effects. The review concluded that essential oils can be effectively incorporated into topical formulations to improve therapeutic benefits and product quality. This study provides scientific support for using essential oils in herbal pain relief balms.

J. A. Duke, in the *Handbook of Medicinal Herbs*, provided detailed information about various medicinal plants and their pharmacological properties. The book described the therapeutic importance of essential oils and herbal extracts in traditional and modern medicine. Clove was identified as an effective analgesic and antiseptic herb, whereas eucalyptus was recognized for its anti-inflammatory, antimicrobial, and cooling properties. The handbook highlighted the medicinal uses of these herbs in treating pain, respiratory disorders, and infections. The information presented serves as a valuable reference for developing herbal formulations such as pain relief balms.

K. Singh and A. Sharma formulated and evaluated a herbal analgesic balm containing natural oils and herbal ingredients. The prepared formulation was assessed for parameters such as consistency, spreadability, homogeneity, stability, and therapeutic effectiveness. The study reported that the herbal balm showed satisfactory physicochemical properties and effective pain-relieving activity. The authors concluded that herbal balms prepared with essential oils provide rapid relief from muscular pain and inflammation with minimal side effects. Their research supports the formulation of herbal pain relief balms using clove and eucalyptus oil.

M. M. Cowan reviewed the antimicrobial properties of plant-derived products and their applications in medicine. The study explained that phytochemicals such as phenols, terpenoids, and alkaloids contribute to the antimicrobial activity of medicinal plants. Essential oils were found to possess significant antibacterial and antifungal properties against various pathogenic microorganisms. The review emphasized the increasing importance of herbal medicines in modern healthcare due to their safety and therapeutic effectiveness. This work supports the use of herbal ingredients in topical pain relief formulations for enhanced medicinal benefits.

T. R. Mahalingam evaluated herbal formulations developed for topical drug delivery systems. The study discussed the advantages of topical herbal preparations such as easy application, localized action, reduced systemic side effects, and improved patient compliance. Various evaluation parameters including spreadability, viscosity, pH, stability, and homogeneity were examined to determine product quality. The author concluded that herbal topical formulations containing essential oils are effective for delivering therapeutic agents through the skin. The findings are relevant for the formulation and evaluation of herbal pain relief balms.

B. S. Nayak, S. S. Sandiford, and A. Maxwell investigated the wound-healing activity of ethanolic extract of *Morinda citrifolia*. The study demonstrated that herbal extracts promote tissue repair, reduce inflammation, and enhance healing processes due to their bioactive constituents. The authors highlighted the therapeutic potential of medicinal plants in topical healthcare products. Their findings support the use of herbal ingredients in formulations intended for pain relief and skin protection. The research also emphasized the growing importance of natural products in developing safe and effective pharmaceutical preparations.

III. MATERIAL AND METHOD

Materials

The materials used for the formulation of herbal pain relief balm were obtained from local pharmaceutical and herbal suppliers. Clove oil and eucalyptus oil were used as the major active ingredients because of their

analgesic, anti-inflammatory, and soothing properties. Beeswax was used as a stiffening agent, while petroleum jelly served as the ointment base. Menthol and camphor were incorporated to provide cooling and pain-relieving effects. All the chemicals and ingredients used in the study were of analytical grade.

Table 1: List of Materials Used

S. No.	Ingredient	Quantity	Function
1	Clove Oil	2 mL	Analgesic and antimicrobial agent
2	Eucalyptus Oil	2 mL	Cooling and anti-inflammatory agent
3	Menthol	1 g	Cooling agent
4	Camphor	1 g	Pain relief agent
5	Beeswax	5 g	Thickening agent
6	Petroleum Jelly	20 g	Balm base
7	Coconut Oil	5 mL	Moisturizing agent





Method of Preparation

The herbal pain relief balm was prepared by using the fusion method. Initially, beeswax and petroleum jelly were taken in a clean beaker and melted together using a water bath at controlled temperature. After complete melting, coconut oil was added slowly with continuous stirring to obtain a uniform mixture. Menthol and camphor were then added and mixed properly until dissolved completely.



After cooling the mixture slightly, clove oil and eucalyptus oil were incorporated gradually with continuous stirring to ensure uniform distribution of active ingredients throughout the formulation. The prepared balm was then transferred into clean, dry containers and allowed to cool at room temperature until solidification occurred. The final product was stored in airtight containers for further evaluation studies.

The figure illustrates the step-by-step process of preparing clarified honey or purified liquid honey. In step 1, raw honey is collected in a metal bowl and gently heated to reduce its thickness and improve flowability. In step 2, the honey is continuously stirred while heating, which helps in melting the crystallized particles and removing foam or impurities, formed on the surface. In step 3, the heated honey is filtered using a fine metal strainer to separate wax particles, bee residues, and other unwanted materials. Finally, in step 4, the purified and filtered honey is transferred into a clean glass container, resulting in a smooth, clear, and ready-to-use honey product. This process improves the appearance, texture, and quality of honey for storage and consumption.

Evaluation Parameters

The prepared herbal balm was evaluated for various physicochemical parameters to determine its quality, stability, and effectiveness.

1. Physical Appearance

The formulated balm was visually examined for color, texture, smoothness, and appearance.

2. Odor

The odor of the balm was evaluated manually to identify the characteristic smell of herbal ingredients and essential oils.

3. Consistency

The consistency of the formulation was checked by applying a small quantity of balm on the skin surface to determine uniformity and smoothness.

4. Homogeneity

The prepared balm was tested for homogeneity by visual inspection to ensure the absence of lumps and coarse particles.

5. Spreadability

Spreadability was determined by applying the balm between two glass slides and measuring the ease of spreading.

6. Washability

Washability was evaluated by applying the balm on the skin and washing it with water to observe the ease of removal.

7. pH Determination

The pH of the formulation was measured using a digital pH meter to ensure skin compatibility.

8. Stability Study

The stability study was performed by storing the balm at different temperature conditions for a specified period and observing changes in color, odor, texture, and consistency.

IV. RESULTS AND DISCUSSION

The herbal pain relief balm formulated using clove oil and eucalyptus oil was successfully prepared by the fusion method. The prepared formulation showed good appearance, smooth texture, pleasant odor, and satisfactory consistency. The incorporation of natural essential oils provided a cooling and soothing effect, making the balm suitable for topical application. The balm was evaluated for various physicochemical parameters including color, odor, homogeneity, spreadability, washability, pH, and stability.

The formulation exhibited a uniform and homogeneous nature without the presence of lumps or coarse particles. The spreadability of the balm was found to be satisfactory, indicating easy application on the skin surface. The prepared balm also showed good washability and did not produce any irritation during topical application. The pH of the formulation was observed within the acceptable range for skin compatibility, indicating that the balm is safe for external use.

The stability studies performed at different storage conditions revealed no significant changes in color, odor, texture, or consistency during the study period. This indicates that the formulation possesses good physical stability and can maintain its therapeutic properties during storage.

The analgesic and soothing effects observed in the

formulation may be attributed to the presence of eugenol in clove oil and cooling constituents present in eucalyptus oil, menthol, and camphor. These herbal ingredients provide relief from muscular pain, headache, inflammation, and minor body aches. The combination of natural ingredients enhanced the effectiveness of the formulation while minimizing the risk of adverse side effects commonly associated with synthetic pain relief products.

Table 2: Evaluation Results of Herbal Pain Relief Balm

S. No.	Parameter	Observation
1	Color	Light yellow
2	Odor	Pleasant aromatic
3	Texture	Smooth
4	Consistency	Good
5	Homogeneity	Homogeneous
6	Spreadability	Easily spreadable
7	Washability	Easily washable
8	pH	6.5
9	Skin Irritation	No irritation
10	Stability	Stable

Discussion

The results obtained from the evaluation confirmed that the formulated herbal balm possessed desirable physicochemical characteristics suitable for topical use. The use of beeswax and petroleum jelly provided appropriate consistency and stability to the formulation, while clove oil and eucalyptus oil contributed significantly to the therapeutic activity of the balm. Menthol and camphor enhanced the cooling sensation and improved the pain-relieving action.

The herbal formulation demonstrated several advantages such as natural composition, easy application, pleasant odor, and reduced possibility of side effects. Compared to synthetic formulations, the prepared herbal balm may offer safer and economical pain management therapy. Therefore, the developed herbal pain relief balm can be considered an effective alternative for the treatment of muscular pain, headache, inflammation, and minor body discomfort.

V. CONCLUSION

It can be concluded from the present investigation that proper selection of polymers and drug is a prerequisite for designing and developing a transdermal drug

delivery. The physical compatibility studies suggest that polymers selected i.e., Carbopol 934, HPMC K 100 M and Xanthan gum were found to be compatible with drug *Clerodendrum serratum*. The varying concentration of the three polymers was found to affect the gel parameters like viscosity and spreadability. Gel formulations prepared with Carbopol 934, HPMC K 100 M and Xanthan gum showed good homogeneity, no skin irritation, good stability and anti-inflammatory activity. However, the Xanthan gum-based gel proved to be the formula of choice, since it showed the highest percentage of extrudability, good spreadability and rheological properties. Formulation F5 with 1 % leaves extract and F11 with 1% root extract of *Clerodendrum serratum* showed the best formulation with significant anti-inflammatory activity. Formulation F5 and F11 shows approximately equal anti-inflammatory activity. Hence, there is no need to use roots for the preparation of medicines for anti-inflammatory action. With the understanding that natural medicines are less likely to have negative effects than synthetic and semisynthetic ones, they are more accepted. Herbal hair gels assist in repairing the numerous harms produced by chemical agents in a variety of commercially available products. The hair gels that contain flaxseed and chia seed which are both rich in omega-3 fatty acids and antioxidants, they may promote healthy hair growth and reduce hair damage.

Vitamin E is also known for its hair-nourishing properties, while lavender oil is believed to have soothing and anti-inflammatory effects on the scalp. It's an attempt made to work out the herbal hair gel that containing various concentration of herbal extract. The formulated herbal hair gel is employed for the purpose of moisturizing & nourishing the hair and preventing the hair fall. The formulation results suggest the hair gel can be used as a natural alternative in the cosmetic industry. Further research can explore the inclusion of additional plant extracts to enhance the properties.

REFERENCES

- [1] P. M. Davidson and T. M. Taylor, "Chemical Preservatives and Natural Antimicrobial Compounds," in *Food Microbiology: Fundamentals and Frontiers*, 3rd ed., Washington, DC, USA: ASM Press, 2007, pp. 713–745.
- [2] M. Soković, J. Glamočlija, P. D. Marin, D. Brkić, and L. J. L. D. van Griensven, "Antibacterial Effects of the Essential Oils of Commonly Consumed Medicinal Herbs Using an In Vitro Model," *Molecules*, vol. 15, no. 11, pp. 7532–7546, 2010.
- [3] A. Prashar, I. C. Locke, and C. S. Evans, "Cytotoxicity of Lavender Oil and Its Major Components to Human Skin Cells," *Cell Proliferation*, vol. 37, no. 3, pp. 221–229, 2004.
- [4] R. Ali, M. S. Mirza, and S. A. Ashraf, "Herbal Medicines and Their Role in Healthcare Management," *International Journal of Pharmacy and Pharmaceutical Sciences*, vol. 7, no. 5, pp. 17–20, 2015.
- [5] S. Burt, "Essential Oils: Their Antibacterial Properties and Potential Applications in Foods," *International Journal of Food Microbiology*, vol. 94, no. 3, pp. 223–253, 2004.
- [6] J. A. Duke, *Handbook of Medicinal Herbs*, 2nd ed., Boca Raton, FL, USA: CRC Press, 2002.
- [7] K. Singh and A. Sharma, "Formulation and Evaluation of Herbal Analgesic Balm," *Asian Journal of Pharmaceutical Research*, vol. 8, no. 2, pp. 95–101, 2018.
- [8] M. M. Cowan, "Plant Products as Antimicrobial Agents," *Clinical Microbiology Reviews*, vol. 12, no. 4, pp. 564–582, 1999.
- [9] T. R. Mahalingam, "Evaluation of Herbal Formulations for Topical Drug Delivery," *International Journal of Pharmaceutical Sciences Review and Research*, vol. 22, no. 1, pp. 45–52, 2013.
- [10] B. S. Nayak, S. S. Sandiford, and A. Maxwell, "Evaluation of the Wound-Healing Activity of Ethanolic Extract of *Morinda citrifolia*," *Evidence-Based Complementary and Alternative Medicine*, vol. 6, no. 3, pp. 351–356, 2009.
- [11] R. C. Rowe, P. J. Sheskey, and M. E. Quinn, *Handbook of Pharmaceutical Excipients*, 6th ed., London, U.K.: Pharmaceutical Press, 2009.
- [12] S. K. Jain and R. K. Sharma, "Herbal Medicines in Pain Management," *Indian Journal of Natural Products and Resources*, vol. 3, no. 1, pp. 1–8, 2012.
- [13] H. P. Rang, M. M. Dale, J. M. Ritter, and R. J. Flower, *Rang and Dale's Pharmacology*, 6th ed., Edinburgh, U.K.: Churchill Livingstone, 2007.

- [14] A. K. Gupta and N. Mishra, "Formulation and Evaluation of Polyherbal Topical Preparation," *International Research Journal of Pharmacy*, vol. 2, no. 7, pp. 90–94, 2011.
- [15] R. K. Verma and S. Kumari, "Topical Herbal Formulations and Their Applications," *Journal of Chemical and Pharmaceutical Research*, vol. 5, no. 12, pp. 286–290, 2013.
- [16] P. Arora, R. Nanda, S. Karan, and S. Sharma, "Microencapsulation Techniques and Applications," *International Research Journal of Pharmacy*, vol. 2, no. 5, pp. 60–64, 2011.
- [17] K. B. Satheesh Madhav and G. V. S. Madhusudan Rao, "Herbal Drug Standardization and Quality Control," *International Journal of Research in Ayurveda and Pharmacy*, vol. 2, no. 1, pp. 55–57, 2011.
- [18] S. Chouhan, K. Sharma, and S. Guleria, "Antimicrobial Activity of Some Essential Oils—Present Status and Future Perspectives," *Medicines*, vol. 4, no. 3, pp. 1–21, 2017.
- [19] R. K. Sharma, S. Arora, and P. Garg, "Preparation and Evaluation of Herbal Balm Containing Natural Oils," *World Journal of Pharmacy and Pharmaceutical Sciences*, vol. 6, no. 8, pp. 1020–1028, 2017.
- [20] B. V. Ramana, "A Review on Herbal Cosmetics and Cosmeceuticals," *International Journal of Research in Pharmaceutical and Biomedical Sciences*, vol. 3, no. 1, pp. 87–92, 2012.