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Research Article

Formulation and Evaluation of Herbal Analgesic Balm

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Abstract

This study focuses on the development and evaluation of an herbal analgesic balm that combines natural ingredients, including beeswax, petroleum jelly, methyl salicylate, camphor, and essential oils such as peppermint, eucalyptus, and lavender. The balm is designed to provide relief from pain and inflammation, making it suitable for conditions such as headaches, backaches, sore muscles, and joint pain. Three formulations (F1, F2, and F3) were prepared with varying concentrations of active ingredients, and their physical parameters, stability, and skin safety were evaluated. The results showed that formulation F3, with a higher concentration of methyl salicylate (7.5 ml) and a balanced blend of essential oils, exhibited superior analgesic potency and aromatic relief. The balm demonstrated good stability, spreadability, and washability, with no signs of phase separation or skin irritation in patch tests. The pH of the formulation was found to be suitable for skin application, ranging from 5.5 to 6.28. Overall, the herbal analgesic balm offers a promising alternative to conventional pain relief products, with potential applications in managing various types of pain and inflammation.

Keywords: Analgesic, Herbal balm, Anti-inflammatory

INTRODUCTION:

Balms are prepared topically to be applied to the skin to reduce stiffness and discomfort. An Ayurvedic mixture of potent essential oils, analgesic herbal balm provides immediate relief from colds, headaches, and backaches. Herbal balms with organic essential oils, organic beeswax, and other suitable herbal ingredients are medicinal topical preparations that can be applied to human skin.[1] A vital link between basic illnesses and secondary consequences is pain. It can set off a harmful and dynamic interaction between biological, social, and psychological elements, which can result in patients' impairment and bad prognosis.[2] According to the International Association for the Study of Pain, pain is a complex phenomenon that includes modulation, affective reactions, nociception, afferents to the central nervous system, endogenous analgesia, behavioral changes, and shifts in social roles.[3] A prevalent, complicated, and upsetting issue, chronic pain has a big influence on both society and people. Although it frequently manifests as a consequence of an injury or illness, it is a distinct condition unto itself and not just a symptom of another illness. Thus, chronic pain has a medical definition as well as its own taxonomy.[4] In effective pain treatment leads to a growing number of health care problems. Inadequate and delayed treatment of acute pain leads to chronic pain, which ultimately results in permanent neural system alterations.[5] Studies on plant constituents were examined based on their chemical classification of active chemicals, which suggests that medicinal plants may create a biological balance and stop the buildup of medical ingredients.[5,6] When tissue is injured, pain emerges.[7] An essential natural defensive system, pain can have a big impact on a person's quality of life. Having a thorough understanding of how pain affects the body is crucial for creating innovative pain management strategies. Nociceptor neurons play a crucial role in inflammation and pain.[8] In response, the person tries to eliminate the unpleasant stimulus.[7] Socio-demographic, psychological, clinical, and biological factors are among the several risk factors for chronic pain.[4] One may say that here are three components to pain: Affective, emotional, and sensory. Significant alterations in pain pathways, an increase in excitability, and modifications to gene expressions, enzymes, and receptors are caused by illness, inflammation, and damage to the central and peripheral nerve systems.[7] Plants are one of the primary sources for the extraction

and purification of secondary metabolites due to their chemical variety. However, humans have long been concerned about pain and have looked to natural sources, primarily plants, for treatment. Accordingly, drugs that cause pain relief can be categorized as analgesics (painkillers).[9] Essential oil constituents are frequently present in foods that impart distinctive flavor and scent. Traditionally employed in aromatherapy for various applications, essential oils are a class of natural compounds with potential biological properties.[10] Numerous natural and synthetic analgesics are available, including opioid analgesics, Aloe vera, Glycyrrhiza glabra, Zingiber Officinale, Eugenia caryophyllata, Cinnamomum camphora, Matricaria pubescens, and others.[11]

Anatomy of the skin:

The skin, which weighs approximately 3 kg and serves several purposes, is the largest organ in the human body. It offers the body's total body barrier protection, keeping toxins and pathogens out and shielding internal organs and tissues from harm. The three distinct layers that make up the epidermis, dermis, and hypodermis are all crucial to its healthy operation.[12]

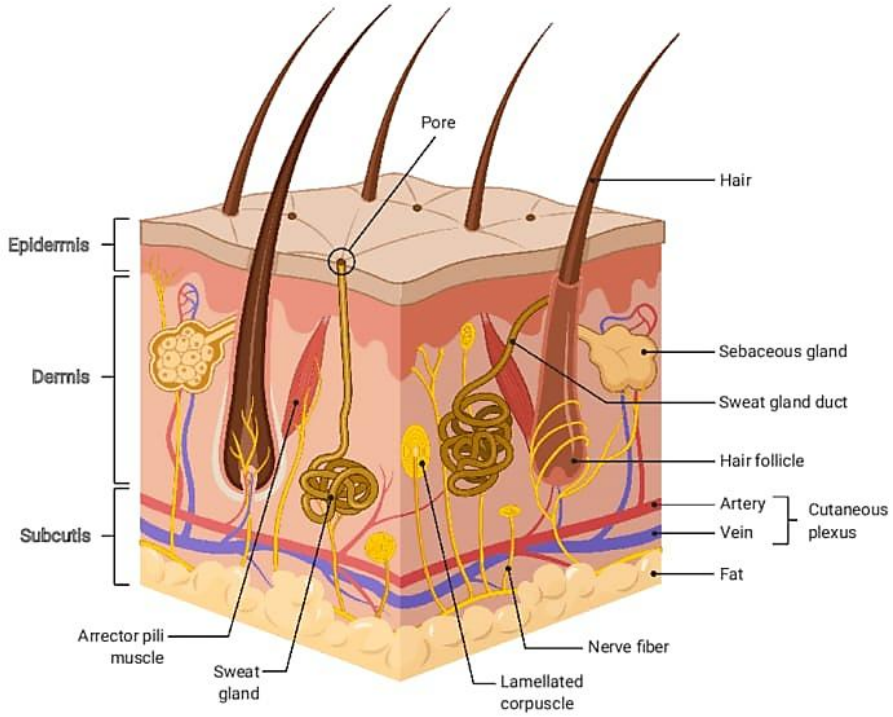

Figure 1: Anatomy of human skin.[13]

Emotional well-being, quality of life, self-perception, and social relationships have all been demonstrated to be significantly impacted by skin quality.[14] In order to maintain homeostasis, the skin acts as an essential barrier between the body's internal systems and the outside world.[15] The process of wound healing is complicated and requires the coordinated activity of numerous tissues and cell types. It necessitates careful coordination of angiogenesis, inflammation, matrix deposition, migration, and proliferation of cells. Larger injuries from trauma, acute illness, or major surgery can take weeks to heal, leaving behind a fibrotic scar that might affect tissue function, while minor skin wounds heal in a matter of days. A deeper understanding of the cellular and molecular processes underlying wound healing is necessary for the development of treatments that successfully treat chronic wounds and avoids carring.[15] Following an injury, the skin's integrity needs to be promptly restored. A variety of skin cell types interact and communicate with one another throughout the extremely cooperative process of wound healing. Inflammation, tissue creation, and tissue remodeling are the three phases of their pair process.[16] Hemostasis, inflammation, proliferation, remodeling, and total tissue repair are the stages of acute wound healing that usually occur in a well-coordinated order.[17]

METHOD AND MATERIALS:

Preparation of Herbal Balm:

1. Materials

Sr. No.	Ingredients	Uses
1	Bees wax	Thickener, Stabilizer
2	Petroleum jelly	Base, Emollient
3	Methyl salicylate	Analgesic, Anti inflammatory
4	Camphor	Warming effect, Pain relief
5	Sodium Benzoate	Preservative
6	Coconut oil	Carrier oil, Moisturizer
7	Tumeric powder	Anti inflammatory, Wound healing
8	Peppermint oil	Cooling effect, Pain relief
9	Eucalyptus oil	Antiseptic, soothing effect
10	Clove oil	Analgesic, Improves circulation
11	Lavender oil	Calming effect, Anti inflammatory
12	Aloe vera	Hydration, Wound healing, Skin lightning
13	Dashmol oil	Joint pain relief

2. Formulation:

Sr no.	Name of Ingredients	F1	F2	F3
1	Bees wax	7.5 gm	7.5 gm	6 gm
2	Petroleum jelly	15.75 gm	15.75 gm	10 gm
3	Methyl salicylate	2.5 ml	1.5 ml	7.5 ml
4	Camphor	2.5 gm	2.5 gm	3 gm
5	Sodium Benzoate	0.25 gm	0.25 gm	0.5 gm
6	Coconut oil	12.5 ml	10 ml	6 ml
7	Tumeric powder	0.5 gm	0.5 gm	1 gm
8	Peppermint oil	_	_	1.5 ml
9	Eucalyptus oil	1 ml	1 ml	2 ml
10	Clove oil	1 ml	0.5 ml	1.5 ml
11	Lavender oil	3 ml	3 ml	1 ml
12	Aloe vera	_	5 gm	3 gm
13	Dashmool oil	3.5 ml	2.5 ml	2 ml
14	Net Quantity	50 ml	50 ml	50 ml

3. Procedure:

Step 1: Preparation of Extracts:

- Fresh aloe leaf was harvested from the botanical garden (outermost leaves).
- Wash thoroughly and cut off the spiny edges and slice the leaf open lengthwise.
- Scoop out the clear gel using a spoon.
- The gel was blended to make it smooth and strained through a muslin cloth to remove the pulp.
- Carrier oil (coconut oil) was gently heated in a double boiler.
- Aloe gel was added to the warm oil in a 1:1 ratio.
- Simmered on very low heat for 1-2 hours, stir occasionally.
- The water from the gel was evaporated and the active compounds infused into the oil.
- The mixture was strained through a muslin cloth.
- Cooled and stored in an airtight container.

Step 2: Preparation of the base:

- In a double boiler, beeswax and petroleum jelly were melted at 60-70 °C until fully liquefied.
- Coconut oil was added and mixed well.

Step 3: Addition of active ingredients

- Once the base is fully melted, methyl salicylate, camphor, and peppermint oil were added.
- Stirred well to ensure uniform distribution.

Step 4: Incorporation of herbal extract and oil:

- The heat is reduced and turmeric powder, aloe vera extract, methyl salicylate, dashmool oil were added and stirred gently until fully dissolved.

Step 5: Addition of essential oils:

- The mixture was allowed to cool down slightly before adding the essential oils such as eucalyptus oil, clove oil, lavender oil to prevent them from evaporating.

Step 6: Addition of preservative and final mixing:

- Sodium benzoate was added as a preservative and mixed until the balm reached a smooth consistency.

Step 7: Filtration of the final product:

- The muslin cloth did the filtration of the formulation.

Step 8: Cooling and packing:

- The warm mixture was poured into the sterilized jar.
- Let it cool at room temperature until the formulation is solidified.
- Sealed and labeled.

Storage:

- Stored in a cool and dry place.

Category:

- Used as an analgesic.

Directions for use:

- To be rubbed externally.
- Rub gently on the skin with the help of finger.
- Do not apply to deep skin cuts or bleeding areas.

Uses:

- Headache
- Backache
- Sore muscles
- Joint pain
- Leg cramps

EVALUATION PARAMETERS:

1] Physical Parameters:

The physical parameters of the herbal analgesic balm were evaluated to ensure quality, consistency, and stability of the formulation. These parameters included:

1. Color – The balm was visually inspected to confirm uniform color throughout the sample, with no discoloration or patchiness.

2. Odor – The balm's scent was checked to ensure it was pleasant and consistent with the herbal ingredients, without any rancid or unusual smell.

2] pH determination:

pH of the formulation was measured by using a calibrated digital pH meter. Balm Solution was prepared by Weighing about 1 gram of herbal balm, add 10 mL of distilled water in a beaker Mix thoroughly using a glass rod to form a uniform emulsion and let the mixture stand for about 10–15 minutes, stirred occasionally. Filtered the mixture through muslin cloth and obtained a clear filtrate. Calibrate the pH meter with standard buffer solutions (pH 4.0). Rinsed the electrode with distilled water and dried then the electrode is dipped into the balm filtrate. The readings are recorded. Readings were noted.

3] Stability Parameters

Physical stability: The physical stability of the herbal analgesic balm was assessed at normal, below normal, and above normal temperatures. At normal room temperature (25°C), the balm remained stable throughout the observation period, retaining its original color, consistency, and aroma without any signs of phase separation. When stored at below normal temperature

(4°C), the balm slightly hardened but returned to its original texture upon warming to room temperature, with no permanent changes observed. However, at above normal temperatures (40°C and 45°C), the balm exhibited minor softening and a slight oily layer on the surface in some samples. Despite these changes, the product did not undergo significant phase separation or degradation, indicating acceptable stability under moderate thermal stress.

4] Skin safety Testing:

Patch test: A patch test was conducted to evaluate the skin compatibility of the herbal analgesic balm. A small area on the inner forearm, measuring approximately 1 inch by 1 inch (2.5 cm × 2.5 cm), was selected and cleaned with an alcohol swab. Around 0.5 grams of the balm was applied evenly to the test site using a sterile cotton swab. The area was then covered with a sterile gauze patch and secured with medical adhesive tape. The patch was left undisturbed for 24 hours, during which the subject was instructed to avoid washing or touching the area. After 24 hours, the patch was removed and the skin was examined for signs of irritation, including redness, itching, swelling, rash, or blistering. A follow-up observation was done after an additional 24–48 hours to detect any delayed skin reactions. No adverse effects indicated the product was safe for topical application on healthy skin.

5] Consistency:

To evaluate the consistency of the herbal analgesic balm, a small quantity of the product was taken using a clean spatula and examined at room temperature. The balm was observed for its texture, spreadability, and uniformity. It was gently pressed and spread on a glass slide or between the fingers to assess whether it was smooth, semi-solid, free from lumps, and homogeneous. The balm was expected to be firm yet pliable, allowing easy application without crumbling or liquefying. Any signs of grittiness, phase separation, or uneven texture were noted. A consistent balm maintained its structure across different portions, indicating good formulation stability.

6] Phase separation:

To assess phase separation, a small amount of herbal analgesic balm was placed in a clean, transparent glass container and observed visually at room temperature. The sample was then subjected to stress conditions, including elevated temperatures of 40°C and 45°C, as well as centrifugation at 3000 rpm for 30 minutes. After each condition, the balm was examined for any visible signs of separation, such as the appearance of an oily layer on the surface, sedimentation at the bottom, or the release of liquid indicating the breakdown of the emulsion. Throughout the testing period, observations were recorded. No separation occurred; the balm was considered physically stable under those conditions.

7] Packaging Evaluation:

Packaging material compatibility: To evaluate the packaging of the herbal analgesic balm, the container was assessed for several key parameters, including functionality, integrity, appearance, and user convenience. The balm was packaged in a sealed, air-tight contain a metal jar with a secure lid to prevent leakage and contamination. The container was examined for leak-proof sealing, ease of opening and closing, and resistance to breakage under normal handling conditions. Additionally, the packaging was checked for compatibility with the product, ensuring that no reaction occurred between the balm and the container material. The overall design and appearance were also considered to ensure it was attractive, informative, and suitable for commercial sales.

8] Washability:

A small quantity of the herbal analgesic balm was applied to the skin, typically on the forearm, and allowed to remain for a few minutes to simulate normal use. The area was then washed with lukewarm water, both with and without mild soap, to evaluate how easily the balm could be removed. The ease of removal, presence of any oily or sticky residue, and the amount of water or soap required were noted. If the balm was easily washed off without leaving a greasy film or requiring excessive scrubbing, it was considered to have good washability. All observations were recorded to determine the product's user-friendliness and post-use cleanliness.

RESULT AND DISCUSSION:

Physical observation

Batches	F1	F2	F3
Colour	Light Yellow	Light Yellow	Yellow
Appearance	Smooth	Smooth	Smooth
Consistency	Semisolid	Semisolid	Semisolid

Final observation

Formulation	Colour	Consistency	pH	Irritation	Phase separation
Marketed	Red	Semisolid	5.5 to 6	No irritation	No phase separation
F3	yellow	Semisolid	6.28	No irritation	No phase separation

DISCUSSION:

Among the three formulations (F1, F2, F3), F3 stands out as the most effective in terms of analgesic potency, herbal balance, and aromatic relief. Here's a detailed comparison and why F3 is superior:

1. **Stronger Pain Relief:** 7.5 ml of methyl salicylate provides more potent analgesic action. Combined with 3 g camphor, 2 ml eucalyptus, and 1.5 ml peppermint oil, the synergy enhances pain and inflammation relief.
2. **Well-rounded Herbal Profile:** Includes turmeric, aloe vera, dashmool oil, and lavender oil for anti-inflammatory, calming, and skin-healing properties.
3. **Aromatic and Soothing:** Balanced scent profile from lavender, eucalyptus, clove, and peppermint oils.
4. **Preservation:** 0.5 g sodium benzoate is appropriate for 50 g balm, ensuring better shelf-life.

Formulation F1:

1. **Low Methyl Salicylate (2.5 ml):** Provides mild to moderate analgesic effect, may be insufficient for stronger pain relief.
2. **Lacks Peppermint Oil and Aloe Vera:** No peppermint oil: Reduces the cooling sensation and synergy with camphor. No aloe vera: Misses out on soothing, healing, and moisturizing effects for the skin.
3. **Lower Herbal Synergy:** Though it has lavender and dashmool, it's not as well-rounded in anti-inflammatory or calming herbs.
4. **Preservative Dose (0.25 g Sodium Benzoate):** Acceptable but minimal could reduce shelf life if moisture is present from other components.

Formulation F2:

1. **Very Low Methyl Salicylate (1.5 ml):** Too weak for adequate analgesia, especially for moderate or chronic pain.
2. **No Peppermint Oil:** Loses the cooling and invigorating properties that support pain relief and scent profile.
3. **Weak Herbal and Oil Content:** Most ingredients are at lower concentrations, including turmeric, clove oil, and dashmool oil, making it less therapeutically robust.
4. **Softer Texture Risk:** Base oils and aloe vera increase moisture, but beeswax isn't increased to compensate; this may result in too soft or semi-liquid consistency

Figure 2: Final product of Herbal Balm

CONCLUSION:

The developed herbal analgesic balm, particularly formulation F3, shows significant promise as a topical pain relief product. The combination of natural ingredients, including methyl salicylate, camphor, and essential oils, provides a potent analgesic effect, while the balm's stability and skin safety profiles are favorable. The product's ease of application, spreadability, and washability make it a user-friendly option. With its potential to provide relief from various types of pain and inflammation, this herbal balm could be a valuable addition to the range of pain management options available. Further studies, including clinical trials, would be necessary to establish the efficacy and safety of this product fully. Nonetheless, the findings of this study suggest that the herbal analgesic balm is a promising natural alternative for pain relief, warranting further investigation and development.

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REFERENCES

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 herbalactive ingredient, J. Young Pharm. 2017;9(3) 303-306. https://doi.org/10.5530/jyp.2017.9.60

8. Karcz M, Abd-Elsayed 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 tomodel 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 Harb Perspect Biol. 2022 Jul 1;14(7):a040840. https://doi.org/10.1101/cshperspect.a040840 PMid:34607830 PMCid:PMC8977401