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Formulation And Evaluation Of Polyherbal Pain Relief Spray

Mr. Ankush M. Lonkar[1*], Mr. Vaibhav G. Akhand[2] and Dr. Swati P. Deshmukh[3]

[1]Department of Pharmacy, Shraddha institute of Pharmacy, washim, Maharashtra, India

[2]Department of Quality Assurance, Shraddha institute of Pharmacy, washim, Maharashtra, India

[3]Department of Pharmacology, Shraddha institute of Pharmacy, washim, Maharashtra, India

ABSTRACT

Oral drugs are commonly prescribed for the treatment of acute pain other than thee agents certain anticonvulsant and antidepressant are also prescribed for chronic pain. although being effective in providing pain relief, oral administration frequently result in systemic adverse drug reaction which may prevent their on going use and result in their discontinuation with the growing interest in herbal therapies among persons associated with chronic pain. Inflammation, arthritis or other medical conditions. There exist a need for formulation and evaluation of herbal pain relief spray topical analgesics are useful to provide symptomatic benefits seen with oral agents but devoid of the systematic ADRs essential oil extracted from plant some of which are known analgesic compounds like essential ginger oil. Peppermint oil, eucalyptus oil. Camphor. the material we used have not been use to make this pain relief spray before the aim of the study was to evaluate the sensorial profiling of newly formulate the rapid action spray in meeting the consumer expectation a s topical pain relief

KEYWORDS: Polyherbal, pain relief spray, analgesic, anti-inflammatory, herbal formulation, topical application.

INTRODUCTION

Pain is a common and debilitating condition affecting millions of people worldwide, often resulting from inflammation, injuries, muscle strain, or chronic disorders like arthritis. Conventional pain management relies on nonsteroidal anti-inflammatory drugs (NSAIDs), corticosteroids, and opioids, which, despite their efficacy, pose risks such as gastrointestinal irritation, liver toxicity, and dependency. Due to these concerns, there is a growing demand for herbal-based pain relief formulations that offer effective treatment with minimal side effects. Topical pain relief formulations, such as sprays, gels, and creams, provide localized treatment, reducing systemic absorption and minimizing adverse effects. Among these, pain relief sprays have gained popularity due to their ease of application, rapid absorption, and non-greasy nature. A polyherbal approach, which involves the combination of multiple medicinal plant extracts, is believed to enhance therapeutic efficacy through synergistic mechanisms such as anti-inflammatory, analgesic, and counterirritant actions.[1]

This study focuses on the formulation and evaluation of a polyherbal pain relief spray using extracts from Mentha arvensis (peppermint), Eucalyptus globulus (eucalyptus), Zingiber officinale (ginger), Curcuma longa (turmeric). These medicinal plants are known for their pain-relieving and anti-inflammatory properties, acting through mechanisms such as inhibition of inflammatory mediators, improvement of blood circulation, and cooling or warming effects on the skin.[2]

The research aims to develop an effective, fast-acting, and skin-friendly herbal spray and evaluate its physicochemical properties, stability, efficacy, and safety. By integrating traditional herbal knowledge with modern pharmaceutical techniques, this study seeks to provide a natural, convenient, and effective alternative for pain management.

The use of medicinal plants for pain relief dates back to ancient civilizations, with traditional systems such as Ayurveda, Traditional Chinese Medicine (TCM), and Unani emphasizing the therapeutic potential of herbs in treating pain and inflammation. Modern scientific research has validated the analgesic and anti-inflammatory properties of many plant extracts, leading to the development of herbal formulations as alternatives to synthetic drugs. Herbal pain relief products are generally well tolerated, offering a natural and safer approach to managing pain without the risk of long-term side effects associated with conventional medications.[3]

Among the various types of topical applications, sprays are preferred due to their ease of application, uniform coverage, and rapid absorption into the skin. Unlike ointments or gels, sprays allow non-contact application, making them more hygienic and suitable for individuals with mobility issues or those experiencing acute pain conditions. By utilizing a polyherbal combination, the formulation aims to enhance pain relief through multiple mechanisms of action, ensuring faster onset and prolonged therapeutic effects.[4]

The key ingredients in this study include:

Mentha arvensis (Peppermint): Provides a cooling sensation and acts as a counterirritant, helping to distract from pain.

Eucalyptus globulus (Eucalyptus): Known for its analgesic and anti-inflammatory properties, it improves blood circulation and reduces muscle stiffness.

Zingiber officinale (Ginger): Contains bioactive compounds like gingerol, which exhibit strong anti-inflammatory effects, reducing swelling and pain.

Curcuma longa (Turmeric): Rich in curcumin, a potent anti-inflammatory agent that inhibits inflammatory pathways and oxidative stress.[5]

The formulation process involves optimizing the concentration of these plant extracts in a stable, fast-drying, and skin-friendly base to ensure effective penetration and absorption. The prepared formulation is then subjected to various quality control tests, including physicochemical evaluation, stability studies, and efficacy assessments through in vitro and in vivo models.

By addressing the growing demand for safe and effective pain relief solutions, this research aims to develop a scientifically validated herbal pain relief spray that can be commercially viable and widely accepted. The success of this study could contribute to the expansion of herbal-based pharmaceuticals, offering a natural, sustainable, and holistic approach to pain management.[6]

In alternative medicine the essential oils are mostly used as analgesic and anti-inflammatory remedies. It is Described that some compounds that confer the effects of Essential oils and the molecular mechanisms are largely Unknown for example, linalool, a monoterpene compound Commonly found as a major component of several Essential oils has seen reported to produce anti-Nociception in two different pain models in mice although the mechanism of its analgesic effects.

Herb ion newly designed EezpainSpray is soothing and emollient effect that provides relief From localized muscular pain and joint pain on applying Externally. It contains Peppermint oil, Eucalyptus oil, turmeric, Clove Oil, Menthol and Camphor along with excipients to formulate the dosage form as spray.[7]

Sprays, in particular, stand out for their rapid application, uniform dispersion, and non-invasive nature, making them ideal for acute conditions like sprains, bruises, or post-exercise soreness, as well as mild chronic pain such as arthritic discomfort. The volatile nature of spray formulations allows for quick drying and a non-greasy finish, enhancing patient compliance—an attribute less pronounced in thicker topicals.

While synthetic topical analgesics like diclofenac gels and capsaicin creams dominate the market, herbal-based sprays are scarce, representing a niche yet promising area for innovation.[8]

MATERIAL AND EQUIPMENTS

Materials

Table: Materials

Sr.no	Ingredients	Role in formulation
1	Peppermint oil	Cooling , analgesic
2	Eucalyptus oil	Pain relief , anti-inflammatory
3	Camphor	Counter irritant, Improve circular motion
4	Clove oil	Mild anaesthetic, antimicrobial
5	Ginger extract	Warming effect, Circular boost
6	Turmeric extract	Anti-inflammatory
7	Ethanol	Solvent quickly diluent
8	Distilled Water	Diluents
9	Glycerin	Skin hydration
10	Sodium benzoate	Preservatives
11	Potassium sorbet	Preservatives

Equipment's

Sr.No.	Apparatus	Purpose
1	Beaker	Use for mixing, stirring and heating a liquid
2	Round bottom flask	Use for uniform heating and distillation process
3	Stirrer	Used to a mix
4	Waterbath	Provide a control temperature environment for heating substance
5	pH meter	Measure of the acidity of alkalinity (pH) of the solution
6	Glass slide	To check the Spreadability
7	Spray bottle	Used for applying liquid formulation evenly on surface
8	Soxhlet aaparatus	Use to continuous extraction of bioactive compounds from plant material

METHOD

Method of preparation

1. Selection of herb and ingredients
2. Extraction of herbal ingredients
3. Formulation of spray solution
4. Mixing and homogenisation
5. Filtration and filling
6. Packaging and labelling

1.Selection of Herbs and Ingredients

Choose high-quality raw materials: peppermint oil, eucalyptus oil, camphor, clove oil, ginger extract, turmeric extract, ethanol, distilled water, glycerin, sodium benzoate, and potassium sorbate.
Ensure all ingredients are pharmaceutical or cosmetic grade.[9]

2. Extraction of Herbal Ingredients

Use Soxlate methods extraction to obtain concentrated extracts (for turmeric and ginger).
The Soxhlet extraction method is a standard technique for extracting bioactive compounds from plant materials like ginger (Zingiber officinale). Below is a step-by-step extraction procedure using the Soxhlet apparatus.

- **Materials Required**

- Dried ginger powder (coarsely ground)
- Soxhlet extractor setup (flask, extractor chamber, condenser)
- Solvent (commonly used: ethanol, methanol, or water-ethanol mix)
- Heating mantle or water bath
- Filter paper or thimble

- **Procedure**

a. Preparation of Plant Material
Wash fresh ginger to remove dirt, slice thinly, and dry in shade or oven (at ~40–50°C) until completely moisture-free.
Grind the dried ginger into coarse powder (not too fine).

b. Loading the Extractor
Weigh about 20–30 grams of ginger powder.
Place the powder in a filter paper thimble or wrap it in filter paper and insert it into the Soxhlet extractor chamber.

c. Setting Up the Apparatus
Fill a round-bottom flask with 250–300 ml of solvent (ethanol is commonly used for ginger due to its polarity and efficiency).
Connect the flask to the Soxhlet extractor and the extractor to a reflux condenser.
Ensure all joints are sealed properly using grease or sealing rings.

d. Heating and Extraction
Heat the solvent gently using a heating mantle or water bath.
The solvent will evaporate, condense in the condenser, and drip onto the ginger powder.
The chamber fills until it siphons back into the flask, carrying extracted compounds.
Continue the process for 6–8 hours or until the solvent in the siphon becomes colorless.

e. Recovery of Extract
After the extraction is complete, allow the system to cool.
Filter the extract to remove fine plant particles.Concentrate the filtrate using a rotary evaporator or by gentle heating to remove excess solvent.Filter and concentrate extracts to required volumes as per formulation.[10]

Fig: Soxhlet apparatus

3. Formulation of Spray Solution
Measure and prepare each ingredient according to the selected formulation.
Add ethanol and distilled water to a mixing vessel as a base solvent.
Gradually add essential oils (eucalyptus, peppermint, clove), then the extracts (ginger and turmeric), then add camphor.[11]

4. Mixing and Homogenisation
Mix all components using a magnetic stirrer or homogenizer until a uniform solution is achieved.
Ensure complete dissolution of camphor and proper dispersion of oils and extracts.[12]

5. Filtration and Filling
Filter the solution using a fine muslin cloth or filtration unit to remove any particulate matter.
Fill the filtered solution into clean, sterile spray bottles.[13]

6. Packaging and Labelling
Seal the bottles properly.
Label with formulation, ingredients, usage instructions, batch number, manufacture and expiry dates, and storage instructions.[14]

Sr. No	Ingredients	Quantity	Role in formulation
1	Peppermint oil	3 ml	Cooling , analgesic
2	Eucalyptus oil	5 ml	Pain relief , anti-inflammatory
3	Camphor	2.5 ml	Counter irritant, Improve circular motion
4	Clove oil	2 ml	Mild anaesthetic, antimicrobial
5	Ginger extract	2 ml	Warming effect, Circular boost
6	Turmeric extract	1.5 ml	Anti-inflammatory
7	Ethanol	23 ml	Solvent quickly diluent
8	Distilled Water	9 ml	Diluents
9	Glycerin	3 ml	Skin hydration
10	Sodium benzoate	0.1 g	Preservatives
11	Potassium sorbet	0.01	Preservatives

Table: Formulation Table

EVALUATION

1) **pH**
2) **Droplet size**
3) **Spreadability**
4) **Evaporation test**
5) **Skin irritation test**

1) **pH**

The pH of a topical polyherbal spray is a crucial parameter, as it determines the compatibility of the formulation with the natural skin environment. Skin typically has a slightly acidic pH ranging from 4.5 to 6.5. A formulation outside this range could disrupt the skin barrier, potentially causing irritation or sensitization. To assess the pH, a small amount of the spray is diluted with distilled water in a 1:10 ratio and measured using a calibrated digital pH meter at room temperature. Ideally, the pH for topical formulations should lie between 5.0 and 6.5 to maintain skin integrity and comfort.[15]

2) **Droplet size**

The droplet size plays a significant role in the performance of spray formulations. It affects how well the active ingredients are distributed and absorbed into the skin. Smaller droplets typically offer better surface coverage and quicker absorption. Droplet size can be measured using methods such as optical microscopy, laser diffraction, or dynamic light scattering (DLS). For herbal pain relief sprays, a droplet size between 1 micron and 100 microns is considered ideal. Maintaining a uniform droplet size ensures consistency in drug delivery and user satisfaction.[16]

3) **Spreadability**

The Spreadability is another critical characteristic, reflecting how easily the formulation can be spread across the skin. This parameter is evaluated by placing a fixed quantity of the sample between two glass plates and applying a standard weight. After a specific time, the diameter of the spread formulation is measured. Good spreadability, generally ranging from 5.0 cm to 9.0 cm, is desirable because it facilitates easy application and ensures that the formulation covers the target area efficiently without excessive rubbing[17]

4) **Skin irritation test**

The skin irritation test is performed to ensure the dermatological safety of the formulation. A small quantity of the spray is applied to a selected area of the skin (either on human volunteers or animal models), covered, and observed after 24 hours for any signs of redness, swelling, itching, or other irritation. A formulation that shows no adverse reactions is considered safe for topical use. This test is critical for confirming that the polyherbal spray does not provoke allergic or irritant responses, thereby ensuring consumer safety.[18]

5) **Evaporation test**

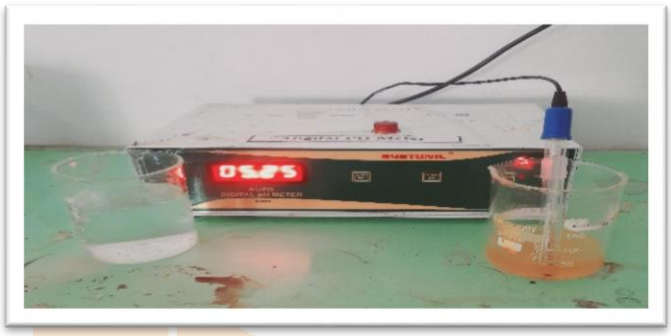
is an important evaluation parameter for polyherbal pain relief sprays, as it helps assess how quickly the solvent (such as water or alcohol) evaporates after the formulation is applied to the skin. This is crucial for ensuring that the active ingredients remain on the skin, while the liquid phase quickly evaporates, leaving a therapeutic layer that can be absorbed. To conduct the test, a precise volume of the spray (e.g., 0.5 mL or 1.0 mL) is applied to a clean, pre-weighed glass surface or watch glass. The initial weight of the spray is recorded immediately after application. The formulation is then left at room temperature (typically around 25°C) to allow the solvent to evaporate naturally. The time taken for the complete evaporation of the solvent is noted, and once evaporation is complete, the surface is weighed again to measure any remaining residue. The percentage of residue left behind can be calculated to evaluate the concentration of active ingredients that remain after evaporation. This test helps determine the spray's drying characteristics and ensures that the formulation delivers its active components effectively while minimizing residual solvent on the skin.[19]

RESULT AND DISCUSSION

Formulations and evaluation of polyherbal pain relief spray was formulated.
The formulation of polyherbal pain relief spray it passed the all-evaluation parameter with better result.

a) **pH**
b) **Droplet size**
c) **Spreadability**
d) **Skin irritation test**
e) **Evaporation test**

a) **pH-** The product's pH balance matters since it has an impact on the skin and surface it is used on.
The pH of our formulated polyherbal pain relief spray is within the optimal range of 4.5 to 6.5. By using



the pH meter, the formulation pH was found to be 5.2.

Fig: pH Test

b) Droplet size – The droplet size falls within the optimal range for topical sprays (1 to 100 microns). This ensures that the droplets are fine enough to provide uniform coverage on the skin but not too small to be difficult to manage. Droplets in this range are ideal for effective drug delivery, ensuring that the active ingredients are evenly distributed across the application area for better absorption and efficacy.
The average droplet size was measured to be 45 microns.

c) Spreadability test

The spreadability test was performed by using a specific amount of spray and applying it onto the glass slide. The time required for the formulation to spread and cover the slide the or surface evenly was measured, with the goal of determining the ease with which the spray could be applied over a given area.
Spreadability of the formulations were found to be in the range of 5.6 cm to 8.7 cm

Fig: Spreadabilty Test

d)Skin irritation test

The skin irritation test showed no signs of irritation (redness, swelling, or itching) after 24 hours of application on the forearm skin
The polyherbal spray did not cause any dermatological reactions, indicating that it is safe for topical use. The formulation is well-tolerated by the skin, suggesting it is suitable for individuals with sensitive skin or for frequent application.

Fig: Skin irritation test

e) Evaporation test

The evaporation time for the spray was 6 minutes, with a residue of 0.25 mg left on the glass surface.The quick evaporation time (6 minutes) and the minimal residue left behind (0.05%) suggest that the formulation dries quickly on the skin, leaving behind the active ingredients while avoiding excessive wetness. This ensures user comfort and maximizes the absorption of active components. The low residue is ideal, as it indicates that the active ingredients are absorbed without leaving an uncomfortable sticky layer on the skin.

Fig: Evaporation test

SUMMARY

Topical analgesic drugs are used to treat both acute pain (strains, sprains, tendonitis, acute back pain, muscle aches) and chronic pain (osteoarthritis of hand or knee, low back pain, and specific types of neuropathic pain). Oral drugs are commonly prescribed for the treatment of acute pain. Also prescribed for Other than these agents, certain anticonvulsants and antidepressants are also chronic pain. Although being effective inproviding pain relief, oral administration frequently results in systemic adverse drug reactions (ADRs), which may prevent their ongoing use and result in their discontinuation. With the growing interest in Herbal Therapies among persons associated with chronic pain, inflammation, Arthritis, or other medical conditions. There exists a need for formulation & evaluation of Herbal pain relief spray Topical analgesics are useful to provide symptomatic benefits seen with oral agents butdevoid of the systemic ADRs. Essential oils extracted from plants, some of which are known analgesic compounds like essential ginger oil, peppermint oil, eucalyptus oil, camphor, turpentine oil. The materials we used have not been used to make this pain relief spray before. The aim of this study was to evaluate the sensorial profiling of newly formulate the rapid action spray in meeting the consumer expectations as topical pain relief spray.

CONCLUSION

Formulation and evaluation of analgesic spray was formulated is concluded that herbal pain relief spray has shown efficacy in mild to moderate cases on applying on affected area. Pain relief spray is used for relieving symptoms such as pain and inflammation. Therefore whenever you experience symptoms of pain and inflammation disorders, you should use a pain relief spray.:

herbal pain relief spray has shown efficacy in mild to moderate cases on applying on affected area. Pain relief spray is used for relieving symptoms such as pain and inflammation. Therefore, whenever you experience symptoms of pain and inflammation disorders, you should use a pain-relieving spray. However, proper precautions should always be observed to ensure that the spray does not harm anyone. If symptoms persist for more than 7 days after applying pain relief spray, you should not hesitate to seek help from a medical practitioner.

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