Development and Characterization of Herbal Analgesic Oil Using Traditional Medicinal Plants

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ABSTRACT

Specifically for the treatment of musculoskeletal pain and inflammation, herbal analgesic oils have drawn a lot of interest as safe and efficient substitutes for synthetic painkillers. In this study, a blend of traditional medicinal plants, including Vitex negundo (Nirgundi), Tinospora cordifolia (Guduchi), Aegle marmelos (Bilva), Acorus calamus (Sweet Flag), and Ficus religiosa (Pipal), is used to formulate and evaluate a herbal analgesic oil in a base of sesame and mustard oils. Organoleptic characteristics, physicochemical parameters (pH, viscosity), phytochemical screening, and microbiological safety tests were among the many assessments that were performed on the manufactured oil. The findings showed a transparent, fragrant oil with a moderate viscosity that is appropriate for topical use and a pH that is compatible with human skin. The existence of important bioactive substances such flavonoids, alkaloids, tannins, and terpenoids—which support its analgesic and anti-inflammatory properties—was verified by phytochemical analysis. The formulation's safety with a low microbial load and no pathogens was guaranteed by microbiological evaluation. According to the results, the herbal analgesic oil is a potential natural treatment alternative for pain management, and more clinical research is necessary to determine its effectiveness in vivo.

Keywords: Analgesic, Traditional, Phytochemical, Effectiveness, Painkiller.

1. INTRODUCTION

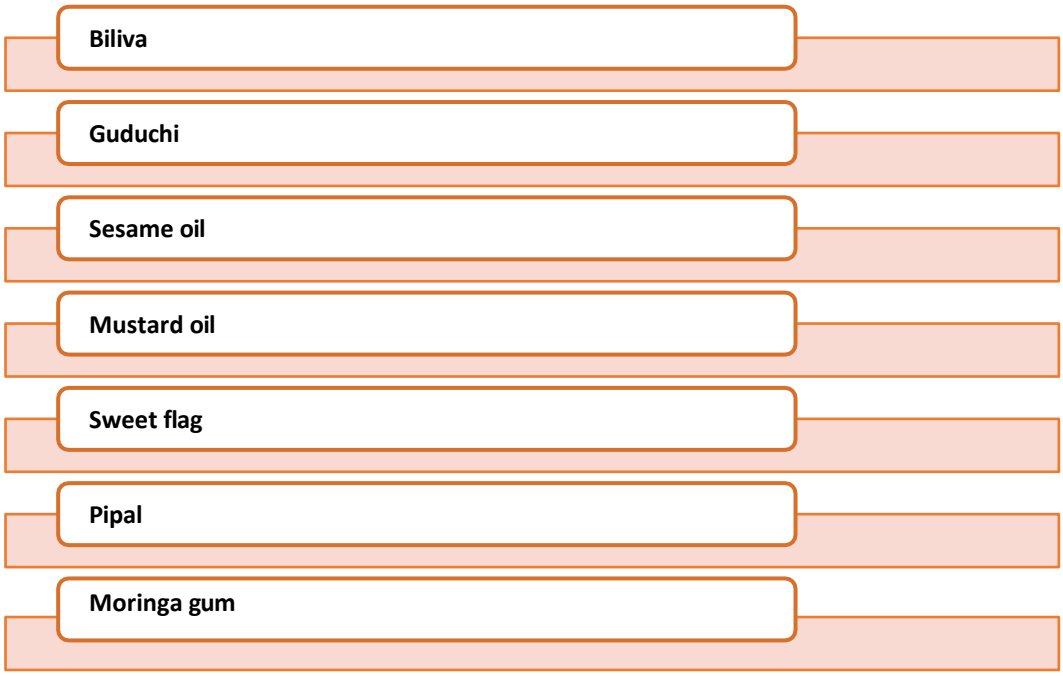
Traditional medical systems including Ayurveda, Unani, and Traditional Chinese Medicine have long used herbal analgesic oils to treat pain, inflammation, and muscle soreness (1). Essential oils and plant extracts with analgesic, anti-inflammatory, antispasmodic, and calming qualities are frequently combined in these compositions. Herbal oils provide a natural, non-invasive substitute for synthetic analgesics with fewer adverse effects, making them appropriate for localized, long-term usage (2).

The complex phytochemical content of herbal analgesic oils, which includes terpenes, flavonoids, alkaloids, and essential fatty acids, is responsible for their medicinal efficiency. These compounds work in concert to enhance blood circulation at the application site and lessen pain perception. Menthol, eucalyptus oil, camphor, clove oil, wintergreen oil, and turmeric extract are common substances that individually contribute to certain pharmacological activities such nerve desensitization, muscular relaxation, or counter- irritation (3,4).

For ailments including arthritic pain, muscle sprains, backaches, joint stiffness, and neuralgia, topical applications of herbal analgesic oils are commonly utilized. With the help of their transdermal delivery system, the active ingredients may quickly and precisely relieve pain by penetrating the skin and reaching the underlying tissues. Modern phytopharmaceutical research has turned its attention to the creation and scientific assessment of herbal analgesic oils in response to the rising public desire for plant-based, environmentally friendly, and side-effect-free treatments (2,5).

Described as "Ostokhoddous" in Iran, Lavandula angustifolia Mill. (Lamiaceae) is a fragrant herb that grows abundantly (Omidbaigi, 2000). The toiletry and fragrance industries are the main users of plant flowers and essential oils (Evans, 1989). People are familiar with Lavandula angustifolia as a potent, fragrant, and therapeutic plant. Many gastrointestinal, neurological, and rheumatic conditions are treated with the plant in traditional and folk remedies around the globe (Duke, 1989; Evans, 1989; Leung and Foster, 1996). Iranian folk and traditional medicine have also utilized the plant's infusions as a diuretic, carminative, anti-epileptic, anti-rheumatic, and pain reliever, particularly for migraine and anxious headaches (6).

2. Role of Selected drug in Formulation of Herbal Analgesics Oil-



a) Biliva

In Ayurvedic medicine, bilva (Aegle marmelos), sometimes referred to as bael, is a highly esteemed medicinal plant that has long been prized for its many therapeutic uses. Bilva is widely used for its anti-diarrheal and digestive properties, but it also has strong analgesic and anti-inflammatory properties, which makes it a suitable ingredient in formulations for herbal analgesic oils (7).

Fig no.1 Biliva

b) Guduchi

In traditional Ayurvedic medicine, guduchi—also called Tinospora cordifolia or "Giloy"—is a highly prized medicinal plant renowned for its antioxidant, immunomodulatory, analgesic, and anti-inflammatory qualities. Guduchi, traditionally known as "Amrita" (meaning "nectar of immortality"), is being utilized more and more in herbal analgesic oil formulations to treat musculoskeletal conditions, pain, and edema(3,5).

In both experimental and clinical investigations, the active phytochemicals found in Guduchi's stem and leaves—such as tinosporin, cordifolioside, tinosporide, berberine, and alkaloids—have shown notable anti-nociceptive and anti-inflammatory properties. These substances aid in lowering the synthesis of pro-inflammatory mediators, such as cytokines and prostaglandins, which are important causes of arthritic disorders, joint inflammation, and muscle soreness (9).

Fig no.2 Guduchi

c) Sesame oil

Originating from the seeds of Sesamum indicum, sesame oil is a classic base oil that is utilized extensively in Siddha and Ayurvedic medicinal systems. In formulations for herbal analgesic oils, it functions as both an active medicinal ingredient and a carrier oil. Sesame oil has inherent anti-inflammatory, analgesic, and antioxidant qualities since it is rich in essential fatty acids, antioxidants, and bioactive substances including sesamin, sesamol, and tocopherols (10,11).

Fig no.3 Sesame oil

d) Mustard oil

In herbal and folk medicine, mustard oil—which is made from the seeds of Brassica nigra or Brassica juncea—is frequently used topically to treat musculoskeletal conditions, pain, and inflammation. Mustard oil, well-known for its potent scent and warming properties, is a rubefacient, a chemical that improves blood flow to the skin's surface to assist reduce inflammation, joint pain, and muscle stiffness (11).

The anti-inflammatory, counter-irritating, and antibacterial qualities of mustard oil are attributed to its abundance of allyl isothiocyanate, erucic acid, and omega-3 fatty acids. Applying mustard oil externally causes a localized warming action that improves circulation, relaxes muscles, and lessens pain in rheumatism, arthritis, sprains, and neuralgia. Mustard oil also penetrates deeply into tissues (12).

Fig no.4 Mustard oil

e) Sweet flag

Sweet Flag is a potent medicinal herb with analgesic, anti-inflammatory, antispasmodic, and neuroprotective qualities. It is botanically known as Acorus calamus and is widely referred to as Vacha in Ayurveda. Sweet Flag is increasingly being added to herbal analgesic oil formulations for the treatment of neuromuscular pain, joint problems, and inflammation. Sweet Flag has long been used to treat nerve- related diseases pain, and swelling (11,13).

The anti-inflammatory and pain-relieving properties of Acorus calamus are attributed to the abundance of bioactive substances found in its rhizomes, including eugenol, acorin, calamenol, and asarone. By lowering inflammatory cytokines and sensory nerve excitability, these substances aid in modulating pain pathways, which is why Sweet Flag is especially useful in treating muscular spasms, arthritis-related pain, and neuralgia.

Fig no.5 Sweet Flag

f) Pipal

The sacred fig tree Pipal, formally known as Ficus religiosa, is valued in ancient medical systems like Ayurveda and Siddha for its many medicinal uses. Various portions of the Pipal tree, particularly the bark and leaves, contain strong phytochemicals that contribute to its analgesic and anti-inflammatory properties. These components have long been used for wound healing, inflammation, and pain management (14).

Fig no.6 Pipal

g) Moringa gum

Because of its anti-inflammatory, analgesic, and wound-healing qualities, moringa gum—a natural exudate produced from the stem bark of the Moringa oleifera tree— has long been employed in a variety of herbal medicines. Moringa gum has considerable therapeutic promise, particularly in topical preparations for pain management, even though the leaves and seeds are more frequently researched for nutritional and medicinal purposes (15).

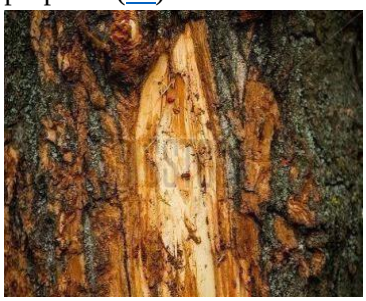


Fig no.7 Moringa Gum

3. MATERIAL & METHOD

The Selection of Herbal Ingredients in the Formulation of Analgesic oil is based on the Medicinal Uses.

S.NO.	INGREDIENT	F1	F2	F3
1.	Sweet flag	**30gm**	**25gm**	**25gm**
2.	Pipal	**30gm**	**25gm**	**20gm**
3.	Guduchi	**30gm**	**20gm**	**35gm**
4.	Bilva	**30gm**	**25gm**	**35gm**
5.	Moringa gum	**20gm**	**15gm**	**25gm**
6.	Sesame oil	**50ml**	**30ml**	**40ml**
7.	Mustard oil	**30ml**	**20ml**	**15ml**

Table no.1: Formulation Table

➢ **Procedure for Making Herbal Analogistic Oil-**

- Mix all herbal powders in 200ml of water.

Fig no.8 Mix and Powder the Ingredient

- Boil and reduce to ~50 mL to obtain a concentrated decoction & Filter it.

Fig no.9 Boil the Ingredients

- In a heavy-bottomed pan, add sesame oil and mustard oil.

Fig no.10 Add the oil

- Heat the mixture on low flame, stirring continuously, until all water evaporates.

Fig no.11 Evaporates the water

- Cool & Filter the oil through a muslin cloth or fine sieve.

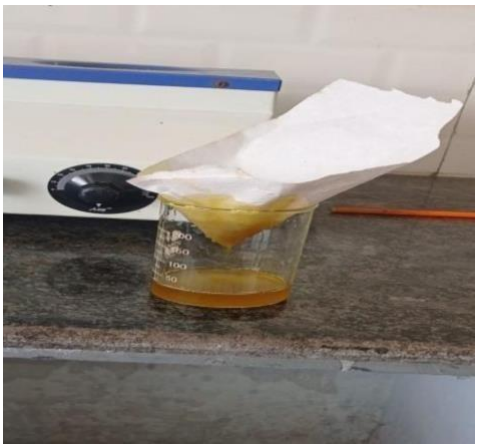


Fig no.12 Filter the oil

- Store in an amber glass bottle or airtight container, away from direct sunlight.

Fig no.13 Stored

4. EVALUATION

a) Organoleptic evaluation

In the first examination of herbal analgesic oil, organoleptic evaluation is vital because it offers instant qualitative insights into the oil's sensory qualities, which are critical for ensuring quality and gaining consumer acceptability. In order to evaluate the physical properties of the oil formulation, the human senses of sight, smell, and touch are used.

b) Phytochemical evaluation

An essential step in verifying the existence of the main bioactive components that give herbal compositions their analgesic, anti-inflammatory, and therapeutic properties is phytochemical examination. To find different secondary metabolites from ingredients like Nirgundi (Vitex negundo), Guduchi (Tinospora cordifolia), Bilva (Aegle marmelos), Sweet Flag (Acorus calamus), and Moringa gum, a qualitative phytochemical screening was done on the current herbal analgesic oil (17).

c) Microbial Evaluation

When evaluating the microbiological safety and quality of herbal analgesic oil, particularly for topical applications, microbial assessment is an essential component. The formulation's stability, safety, and therapeutic effectiveness may be jeopardized by contamination with opportunistic or pathogenic bacteria.

d) pH Evaluation

Herbal analgesic oil's pH assessment is a crucial factor in determining its skin compatibility and reducing the possibility of irritation when applied topically. Herbal analgesic oils sometimes contain water-soluble herbal extracts or emulsified components that might affect their surface pH, even though oils typically do not have a normal aqueous pH (18).

e) Viscosity Evaluation

When it comes to the spreadability, application, and skin absorption of herbal analgesic oil, viscosity is a crucial physicochemical factor. It gives information on the oil's stability and consistency as well as its internal flow resistance (19).

5. RESULT

a) Organoleptic evaluation

S.no	Parameters	Result
1.	Color	Reddish brown color
2.	Physical state	Liquid with greasy in nature
3.	Odor	Pleasant
4.	Solubility	Soluble in non-polar solvents

Table no.2: Organoleptic Evaluation

Fig no.14 Physical appearance

b) Phytochemical Evaluation-

To identify different plant components such as alkaloids, saponins, glycosides, protein, steroids, carbohydrates, and flavonoids, the prepared herbal analgesic oil was put through a qualitative chemical analysis.

S.No.	**Constituents**	**Sesame oil**
1.	Alkaloids	Present(+ve)
2.	Saponins	Present(+ve)

3.	Glycosides	Present(+ve)
4.	Protein	Absent (-ve)
5.	Steroids	Present(+ve)
6.	Carbohydrates	Absent(-ve)
7.	Flavonoids	Present(+ve)

Table no.3: Phytochemical Evaluation

c) Microbial Evaluation

The herbal analgesic oil demonstrated a microbial load well under permissible limits for TAMC and TYMC, with no growth identified for the indicated pathogens. This demonstrates the oil's compatibility for external use and microbiological safety.

Fig no.15 Microbial Test

d) pH Evaluation

The herbal oil sample is often diluted in distilled water (typically at a 1:10 dilution ratio) to create a homogeneous solution that can be used to assess pH. After making sure the electrode is correctly submerged and steady values are acquired, the pH is next measured using a calibrated digital pH meter, Its 6.7 approx.

Fig no.16 ph Test

e) Viscosity

A Brookfield viscometer, a common tool for rheological examination of semi-solid and liquid formulations, was used to evaluate the viscosity of the synthesized herbal oil. To replicate normal storage and usage settings, the test was conducted at room temperature (25 ± 2°C).

Fig no.17 Viscometerr

6. DISCUSSION

A viable and well-liked substitute for synthetic painkillers are herbal analgesic oils, particularly when it comes to treating musculoskeletal pain, joint pain, inflammation, and localized pains. Several plant-based components with anti-inflammatory, analgesic, muscle-relaxing, and circulation-boosting qualities work in concert to create the composition of herbal analgesic oil.

Combining traditional medicinal herbs like Nirgundi (Vitex negundo), Guduchi (Tinospora cordifolia), Bilva (Aegle marmelos), Sweet Flag (Acorus calamus), and Pipal (Ficus religiosa) with carrier oils like sesame and mustard oil—which not only facilitate transdermal delivery but also have inherent therapeutic benefits—was how the herbal analgesic oil was made (20).

Fig no.18 Final Product

7. CONCLUSION

The developed herbal analgesic oil shows great promise as a safe, all-natural treatment for reducing inflammation and pain related to musculoskeletal disorders. Positive findings from phytochemical and physicochemical analyses confirm the synergistic analgesic and anti-inflammatory benefits of incorporating several medicinal plants rich in bioactive phytoconstituents. Good skin compatibility and user acceptance are guaranteed by the oil's ideal viscosity, suitable pH, and advantageous organoleptic qualities. Furthermore, its safety for topical treatment is confirmed by the microbiological investigation. All things considered, this herbal analgesic oil shows promise as a substitute for traditional synthetic medications, providing a more comprehensive and safe method of treating pain with few adverse effects. It is advised that more clinical research be done to confirm its therapeutic effectiveness in human beings (21).

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