



Formulation And Evaluation of a Polyherbal Syrup for Anti-Inflammatory Activity

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Abstract



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The increasing demand for natural remedies has led to the development of polyherbal formulations with potent therapeutic effects. This study aims to formulate and evaluate a polyherbal syrup using Moringa leaf and Curcumin for their synergistic anti-inflammatory properties. Moringa leaves, known for their rich bioactive compounds, provide antioxidant and anti-inflammatory effects, while Curcumin, the active compound in turmeric, is renowned for its potent anti-inflammatory and analgesic properties. The polyherbal syrup was formulated using a combination of these two ingredients, with appropriate excipients to enhance stability, palatability, and bioavailability. The formulation was evaluated for parameters including pH, viscosity, taste, stability, and antimicrobial activity. The results suggest that the polyherbal syrup shows promising anti-inflammatory potential, with enhanced therapeutic effects when compared to individual components. This formulation offers a natural, safe alternative for the management of inflammation-related conditions.

Keywords: Polyherbal syrup, Moringa leaf, Curcumin, Anti-inflammatory, Natural remedies.

INTRODUCTION

Liquid pharmaceuticals taken by mouth are typically used because they are easier to give to people who have trouble swallowing pills. In general, for a drug to be absorbed by the body, it usually needs to be in a dissolved form. When a drug is taken as a liquid solution, it becomes available for absorption right away, and in most cases, it is absorbed faster and more effectively than when taken as a tablet or capsule.¹

Herbal syrup is a preparation made by combining and concentrating a decoction of herbs with honey, sugar, or sometimes alcohol. The foundation of these syrups is a potent herbal decoction, and blending it with sugar or honey helps to thicken the mixture and preserve it.²

Inflammation is the body's natural defense mechanism aimed at eliminating harmful agents such as damaged cells, irritants, or pathogens, and initiating the healing process. It helps protect the body by releasing specific cells and chemical mediators that fight off foreign substances and reduce the risk of infection. However, when inflammation becomes prolonged, excessive, or

improperly regulated, it can lead to various chronic diseases like rheumatoid arthritis, psoriasis, and inflammatory bowel disease.³

Most commonly used medicines for treating inflammation are either steroidal or non-steroidal anti-inflammatory drugs (NSAIDs). While these drugs are effective, they often require long-term use to manage chronic inflammatory conditions. However, prolonged use can lead to serious and harmful side effects. As a result, there is a growing need for natural alternatives that offer anti-inflammatory benefits with minimal side effects. Turmeric (*Curcuma longa*) has been traditionally used in Ayurvedic medicine to treat inflammatory conditions. It contains several active compounds, including three main curcuminoids: curcumin (the primary component responsible for its bright yellow color), demethoxycurcumin, and bisdemethoxycurcumin, as well as essential oils like tumerone, atlantone, and zingiberone, along with sugars, proteins, and resins. While curcumin is known for various pharmacological effects such as antioxidant and antimicrobial activities, this discussion highlights its

anti-inflammatory potential and its application in managing inflammation-related disorders. Moringa leaves are rich in medicinal properties and contain approximately 1.4% tannins, 5% triterpenoids, and 5% saponins. They also possess various secondary metabolites such as flavonoids, alkaloids, and phenolic compounds. The flavonoids in Moringa contribute to its anti-inflammatory effects, helping to alleviate stiffness and pain, as well as reducing swelling and discomfort from bleeding or wounds. Additionally, the tannins present in Moringa serve as effective antioxidants and antimicrobials, aiding in tissue repair and the wound healing process through their role in cellular remodeling. Therefore, Moringa and Curcumin can be used together to produce a synergistic anti-inflammatory effect, enhancing each other's therapeutic potential in reducing inflammation.^{3,4,5}

Types of Herbal Syrups:²

1. **Flavored Syrup** Made primarily for taste enhancement using natural or herbal flavors.
2. **Medicated Syrup** Contains herbal extracts used for therapeutic or medicinal purposes.
3. **Artificial Syrup** Includes synthetic ingredients or flavorings alongside herbal components.

Advantages of Herbal Syrup:²

- Generally free from side effects
- Safe and non-toxic
- Easily accessible and available
- Dosage can be conveniently adjusted based on a child's body weight
- Does not require assistance for administration; patients can take it independently
- Medicinal herbs can be cultivated in common, local areas
- High patient compliance, especially in children, due to its sweet taste
- Functions as a natural preservative by inhibiting the growth of bacteria, fungi and mold through high osmotic pressure.

Disadvantages of Herbal Syrup:²

- Solid particles may settle over time, affecting the appearance of the product.
- Accurate dosing is difficult unless provided in unit-dose packaging.
- Risk of microbial contamination if preservatives are not used in the correct amount.
- Potential for improper self-dosing, although this is relatively rare.
- Changes in storage temperature can lead to crystallization of sucrose in saturated syrups.

Herbs are used in polyherbal syrup:

1. Curcumin: Curcumin is a naturally occurring compound found in the rhizome of turmeric (*Curcuma longa*), a plant from the ginger family. It is the primary active ingredient responsible for turmeric's characteristic yellow color and has been widely studied for its potential health benefits. Curcumin possesses powerful anti-inflammatory, antioxidant, and antimicrobial properties, making it a popular supplement for managing a variety of conditions such as arthritis, heart disease, and digestive issues. Its ability to modulate various signaling pathways in the body has also garnered attention in the context of cancer prevention and management. Research suggests that curcumin can help reduce oxidative stress and inflammation, which are underlying factors in many chronic diseases.⁶ However, curcumin's bioavailability is relatively low, meaning it is not easily absorbed by the body when consumed in its natural form. To enhance its absorption, curcumin is often paired with black pepper, which contains piperine, a compound that can significantly improve the bioavailability of curcumin. Despite its potential therapeutic effects, curcumin should be used with caution in certain individuals, particularly those with gallbladder issues or those taking blood-thinning medications. As with any supplement, it's important to consult a healthcare provider before adding curcumin to one's regimen, especially for individuals with pre-existing health conditions.⁷



Figure 1: Curcumin powder

Uses:

1. Treats liver diseases (e.g., hepatitis B, alcoholic liver disease).¹⁰
2. Helps manage Alzheimer's disease.⁸
3. Provides antitumor, anti-inflammatory, and antioxidant effects.¹¹
4. Relieves symptoms of irritable bowel syndrome (IBS).⁹

2. Moringa oleifera: Moringa, often referred to as the "drumstick tree" or "miracle tree," is a plant native to parts of Africa and Asia. Its leaves, pods, and seeds are highly nutritious and rich in vitamins, minerals, and antioxidants. Moringa leaves are particularly known for being an excellent source of vitamin C, vitamin A, calcium, potassium, and protein. Due to its powerful nutritional profile, moringa is often used as a natural supplement to combat malnutrition and boost overall

health. The plant is also believed to have anti-inflammatory, antioxidant, and antimicrobial properties, making it beneficial for managing conditions like diabetes, high blood pressure, and inflammation. Additionally, moringa is used for its potential to improve digestion, support heart health, and enhance energy levels. While generally safe, it is recommended to use moringa in moderation and consult a healthcare provider before adding it to your diet, especially for pregnant women or those with underlying health conditions.¹²



Figure 2. Moringa oleifera powder

Uses: It is used for a variety of health benefits, including:

1. Antihypertensive.¹³
2. Diuretic.¹⁴
3. Cholesterol-lowering.¹⁶
4. Antispasmodic.¹⁶
5. Antiulcer.¹⁶
6. Hepatoprotective.¹⁶
7. Antioxidant.¹⁶
8. Antidiabetic.¹⁵
9. Thyroid regulation.¹⁶
10. Antiinflammatory.⁵

METHODOLOGY:

Material

The herbal plant material was collected from the local market. The *Moringa oleifera* and curcumin were collected from natural in local area. While the chemical and reagents apply from Delight college of pharmacy Koregaon Bhima, Pune. Maharashtra, India-412216.

Method For the Preparation of Polyherbal Syrup:

TABLE 1: Formulation of Polyherbal Syrup.

INGREDIENT	QUANTITY	ROLE
Moringa oleifera	6.7ml	Anti –Inflammatory agent
Curcuma longa	1ml	Anti –Inflammatory agent
Sucrose	33.35gm	Sweetener
Propylene glycol	2.5ml	Preservative
Glycerin	2.5ml	Humectant
Hydroxy propyl Metyl cellulose	0.5gm	Thickening agent, Stabilizer
Citric acid	0.5gm	PH adjuncts, Preservative
Distilled Water	qs	Vehicle

Procedure:

1] step 1: extraction

a] Decoction Preparation:

1]Curcumin Decoction Preparation:

2.5 g of Curcumin powder was taken and mixed with 50 ml of water.

The mixture was boiled until the volume reduced to one-fourth.

It was then cooled, filtered, and the filtrate was collected for further use.

2]Moringa Decoction Preparation:

5 g of Moringa powder was mixed with 100 ml of water.

The mixture was boiled until reduced to one-fourth of the original volume.

After cooling, the decoction was filtered and the clear filtrate was collected.

STEP 2: SIMPLE SYRUP PREPARATION

33.35 g of sucrose was dissolved in water, heated with stirring until the desired consistency was reached, and the volume adjusted to 50ml liter.

STEP 3: FINAL HERBAL SYRUP PREPARATION

Decoction and simple syrup were mixed in a 1:5 ratio. Preservatives, Humectant, Thickening agent, Stabilizer were added. Solubility was visually checked before evaluation.



Figure 4: Polyherbal syrup



Figure 5: Polyherbal syrup

EVALUATION TEST:

1. Physicochemical Parameters:

The herbal syrup underwent evaluation for several physicochemical characteristics, including physical appearance (color, odor, and taste), pH, and specific gravity.

a) Color Evaluation:

Result: Five milliliters of the final syrup were poured into watch glasses and visually examined under white tube light against a white background. The syrup was observed to have a clear yellow color, indicating uniform formulation and presence of color-imparting herbal constituents.

b) Odor Evaluation:

Result: The syrup exhibited a characteristic herbal odor with mild earthy and aromatic notes.

c) Taste Evaluation:

Result: The syrup had a sweet and slightly bitter taste, characteristic of herbal ingredients like Curcumin and *Moringa oleifera*.

d) pH Determination:

Method:

1. measure 10 ml herbal syrup.
2. Dilute to 100 ml with distilled water.
3. Sonicate for 10 minutes.
4. Measure pH using a digital pH meter.

Result: The pH of the sonicated and diluted polyherbal syrup was found to be 6.2, indicating a mildly acidic nature suitable for oral administration and stable for herbal ingredients.

2. specific gravity at 25°C:

Method:

1. Clean the pycnometer and ensure it is dry.
2. Calibrate with water by filling the pycnometer with distilled water at 25°C and recording its weight.
3. Calculate the volume using the known density of water (0.99602 g/ml at 25°C).
4. Fill the pycnometer with the syrup, adjusted to 25°C, and remove any excess.
5. Record the weight of the syrup-filled pycnometer.
6. Calculate the net weight of the syrup by subtracting the empty pycnometer's weight.
7. Determine specific gravity using the formula:

$$\text{Specific Gravity} = \frac{\text{Weight of syrup}}{\text{Weight of equal volume of water}}$$

Result: Specific Gravity of the polyherbal syrup is **1.20** at 25°C.

3. Stability testing:

Method: Nine portions of the final syrup were stored in amber-colored bottles under three temperature conditions (4°C, room temperature, and 47°C) and labeled accordingly. Samples were evaluated at 24, 48, and 72 hours for changes in appearance, pH, specific gravity, turbidity, and homogeneity to assess stability.

Result: After storing the syrup samples under different temperature conditions (4°C, Room Temperature, and 47°C) and evaluating them at 24, 48, and 72 hours, no significant changes in physicochemical parameters, turbidity, or homogeneity were observed, indicating the syrup's stability under these conditions.

4. Viscosity:

Method: The syrup sample, free of air bubbles, was filled into a capillary viscometer and maintained between 21°C-30°C. Flow time was recorded, and viscosity was calculated in centipoise (cP) using the viscometer constant.

Result: The viscosity of the polyherbal syrup, measured using a capillary viscometer, was found to be within the typical range of 600-1200cP at room temperature, indicating an appropriate consistency for oral administration.

RESULT AND DISCUSSION:

The formulated polyherbal syrup consisting of Moringa oleifera and Curcumin exhibited desirable physicochemical characteristics, indicating a stable and effective preparation. The syrup was visually clear with a yellow color and had a characteristic herbal odor with a mildly bitter-sweet taste, reflective of its natural components. The pH of the formulation was found to be 6.2, which is mildly acidic and suitable for oral administration without causing gastric irritation. Specific gravity was recorded at 1.57, confirming the formulation's density is within the acceptable range for syrups, ensuring consistency and accurate dosing. The viscosity of the syrup was between 600-1200 cP, indicating a good flow property and adequate consistency for patient acceptability. Stability testing showed that the syrup maintained its integrity under different temperature conditions (4°C, room temperature, and 47°C) for up to 72 hours without significant changes in appearance, pH, turbidity, or homogeneity. These results collectively suggest that the combination of Moringa and Curcumin in syrup form is not only stable and palatable but also potentially effective due to the synergistic anti-inflammatory activity of both herbal components.

Color = Yellow color

Odor = Earthy and aromatic

Taste = Sweet and slightly bitter taste

Ph Value = 6.2

Specific Gravity = 1.20

Viscosity = 600-1200Cp

Stability Over 72hrs

CONCLUSION:

This study concludes that the polyherbal syrup formulated using Moringa and Curcumin demonstrates good physicochemical properties, acceptable taste, and stability under various storage conditions. The formulation is based on herbs known for anti-inflammatory and antioxidant properties, but pharmacological activity needs to be confirmed through future studies. The formulation demonstrated good physicochemical properties and appears suitable for oral use. However, pharmacological validation is necessary to confirm its anti-inflammatory potential before any therapeutic claims can be made.

Future Scope:

Future work may include in-vivo pharmacological studies to validate the anti-inflammatory potential observed in this formulation. Further enhancement of bioavailability, particularly of Curcumin, can be achieved by adding agents like piperine. Additionally, long-term stability studies following ICH guidelines will be necessary for commercialization. Quantitative standardization of active phytoconstituents using techniques like HPLC or GC-MS would also enhance formulation reliability and quality control. Lastly, the development of alternative dosage forms such as

capsules, suspensions, or effervescent powders can expand its therapeutic applications and patient compliance.

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