INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: https://www.ijpsjournal.com

OPEN ACCESS

Research Article

Research Article on Formulation and Evaluation of Syrup Using Fenugreek and Bay Leaves for The Treatment of Diabetic Wound Healing

Komal Chavan*, Priya Chaudhari

Gajanan Maharaj College of Pharmacy, Chh, Sambhajinagar.

ARTICLE INFO

Published: 12 June 2025
Keywords:
Herbal Syrup, Fenugreek, Bay Leaves
DOI:
10.5281/zenodo.15649020

ABSTRACT

Diabetes mellitus impairs wound healing due to chronic inflammation, poor circulation, and increased susceptibility to infection. This study aimed to develop a herbal syrup formulation incorporating fenugreek (Trigonella foenum-graecum) and bay leaves (Laurus nobilis)—both known for their antioxidant, anti-inflammatory, and hypoglycemic properties—to support wound healing in diabetic individuals. The syrup was formulated using aqueous extracts of fenugreek seeds and bay leaves, combined with honey as a natural sweetener and stabilizer. Supplementary components such as citric acid, sodium benzoate, and ascorbic acid were added to enhance stability, shelf life, and therapeutic potential. The physicochemical characteristics of the syrup, including pH, viscosity, and microbial stability, were evaluated. Additionally, in vivo assessment using a diabetic rat model demonstrated improved wound closure rates, reduced inflammation, and enhanced tissue regeneration in groups treated with the herbal syrup, compared to untreated diabetic controls. These findings support the therapeutic potential of the formulated syrup as an adjunctive oral treatment for diabetic wound healing. The use of safe, plant-based ingredients presents an affordable and accessible alternative to conventional synthetic drugs. Further clinical trials are recommended to establish efficacy in human subjects and to optimize dosage regimens for clinical application.

INTRODUCTION

Chronic wounds are a common and severe complication of diabetes mellitus, often leading to infection, amputation, and increased healthcare costs. Impaired wound healing in diabetics is multifactorial, involving poor glycaemic control, reduced blood flow, oxidative stress, and delayed tissue regeneration. Conventional treatments often rely on topical antimicrobial agents, debridement,

***Corresponding Author:** Komal Chavan
Address: *Gajanan Maharaj College of Pharmacy, Chh, Sambhajinagar.*
Email ✉: kbchavan.gmcp@gmail.com
Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

and glycaemic management, but many of these approaches are either costly, invasive, or associated with adverse effects. This has generated growing interest in the use of natural, plant-based therapies as supportive treatments for diabetic wound healing.Fenugreek (Trigonella foenum-graecum) and bay leaves (Laurus nobilis) are two medicinal plants extensively used in traditional medicine systems. Fenugreek seeds are rich in alkaloids, flavonoids, and saponins, known for their anti-inflammatory, antioxidant, and glucose-lowering effects. Bay leaves contain essential oils and phenolic compounds like eugenol, which exhibit antimicrobial, anti-inflammatory, and antioxidative properties. Both herbs have shown potential in promoting tissue repair and glycemic control, making them promising candidates for systemic therapy in diabetic wound care.This study focused on formulating a herbal syrup from aqueous extracts of fenugreek and bay leaves for oral administration. Syrup as a dosage form offers ease of consumption, rapid absorption, and improved patient compliance, especially for long-term use. The formulation was designed with additional ingredients such as honey (for its mild antimicrobial action and sweetness), citric acid (for pH stability), sodium benzoate (as a preservative), and ascorbic acid (for wound healing support).The objective of this research was to assess the physicochemical properties, stability, and biological activity of the formulated syrup, particularly its effect on wound healing in diabetic conditions. By leveraging natural compounds with multiple pharmacological actions, this study aims to contribute to safer, cost-effective, and accessible adjunct therapies for diabetic wound management.

1.1Diabetes Mellitus

Definition

Diabetes Mellitus is a chronic metabolic disorder characterized by persistent hyperglycemia (high blood glucose levels) due to defects in insulin secretion, insulin action, or both. It leads to long-term damage and dysfunction in various organs, especially the eyes, kidneys, nerves, heart, and blood vessels.

Classification

According to the American Diabetes Association (ADA), DM is broadly classified into:

1. Type 1 Diabetes Mellitus (T1DM)
2. Type 2 Diabetes Mellitus (T2DM)
3. Gestational Diabetes Mellitus (GDM).

Symptoms

Common symptoms of uncontrolled DM include:

- Polyuria
- Polydipsia
- Polyphagia
- Weight loss
- Fatigue
- Blurred vision

Diabetes and Impaired Wound Healing

Pathophysiological Barriers in Diabetic Wounds:

- Microvascular Damage: Hyperglycemia damages capillaries, reducing oxygen and nutrient delivery.
- Neuropathy: Leads to unrecognized injuries.
- Reduced Growth Factor Activity: Diminished production of EGF, VEGF, and PDGF delays granulation and epithelialization.

- Chronic Inflammation: Persistent pro-inflammatory cytokines (e.g., IL-6, TNF-α) delay healing.
- Oxidative Stress: Excess free radicals damage proteins, lipids, and DNA at the wound site.

The ideal therapy for diabetic wounds should control blood sugar, reduce inflammation, enhance tissue regeneration, and prevent infection.

1.4. Syrup Formulation: A Dual-Action Delivery System

The oral syrup combining fenugreek and bay leaf extracts offers a non-invasive, systemically acting wound therapy for diabetic patients. The syrup contains:

- Fenugreek extract (20% concentration)
- Bay leaf extract (10%)
- Natural sweeteners (honey or fructose)
- Preservatives (citric acid, sodium benzoate)
- Ascorbic acid for immune and collagen support.

1.5. Benefits of Syrup Delivery:

- Patients complains improve.
- Nutritional support.
- Synergistic action enhanced healing .
- Systemic reach- regulate blood glucose.

1.6 Mechanism of Action in Diabetic Wounds

Table no.1 Mechanism of action.

Mechanism	Action by Syrup Components
Glycemic Control	Fenugreek: enhances insulin secretion; Bay leaf: improves insulin sensitivity
Antioxidant Defense	Flavonoids, saponins from both herbs reduce oxidative damage
Anti-inflammatory Response	Eugenol and other terpenoids reduce cytokine storm
Tissue Regeneration	Collagen synthesis boosted by fenugreek and Vitamin C
Infection Prevention	Antimicrobial oils from bay leaves and honey reduce bacterial load

2.1. Drugs and excipients profile

1. Fenugreek Seeds
2. Bay Leaves
3. Honey
4. Ascorbic Acid
5. Citric Acid
6. Sodium Benzoate
7. Glycerine

1 Fenugreek Seeds

- **Scientific name: -**Trigonella foenum-graecum
- **Common name: -** Methi , kasturi methi .
- **Phytochemicals:** 4-hydroxyisoleucine, trigonelline, flavonoids, saponins, alkaloids.
- **Pharmacological Actions:**

➢ Antidiabetic: Enhances insulin secretion and sensitivity.

➢ Wound Healing: Promotes fibroblast activity and collagen synthesis.

➢ Antioxidant: Neutralizes free radicals that delay healing.

➢ Anti-inflammatory: Reduces pro-inflammatory cytokines.

2.Bay Leaves

- **Scientific name**: - Laurus nobilis.

- **Common name: -** Tej patta
- **Phytochemicals:** Eugenol, cineole, flavonoids, tannins.
- **Pharmacological Actions:**

➢ Antidiabetic: Improves glucose metabolism.

➢ Antimicrobial: Inhibits growth of wound pathogens.

➢ Anti-inflammatory: Reduces inflammation around wounds.

➢ Antioxidant: Protects against oxidative tissue damage.

3. Honey (Natural Sweetener & Carrier)

- **Common name:-** Madhu
- **Constituents:** Sugars, hydrogen peroxide, phenolic acids.
- **Pharmacological Actions:**

➢ Antimicrobial: Inhibits bacterial colonization.

➢ Wound Healing: Promotes moist environment and tissue regeneration.

➢ Natural preservative and flavouring agent.

4. Ascorbic Acid (Vitamin C)

- **Pharmacological Actions:**

➢ Collagen Synthesis: Essential for connective tissue repair.

➢ Antioxidant: Enhances immune response and neutralizes ROS.

5.Citric Acid

- **Pharmacological Role:**

➢ Preservative and pH stabilizer**.**

➢ Maintains acidic pH to prevent microbial growth.

6. Sodium Benzoate

- **Pharmacological Role:**

➢ Antimicrobial preservative.

➢ Prevents spoilage and extends shelf life.

7. Glycerin

- **Pharmacological Role:**

➢ Acts as a humectant and solubilizer.

➢ Improves syrup texture and consistency**.**

2.2 Syrup Formulation

Table No.2 Syrup Formulation.

Ingredient	Quantity	Purpose
Fenugreek seed extract	10 mL	Anti-inflammatory, hypoglycemic
Bay leaf extract	5 mL	Antioxidant, antimicrobial
Honey or fructose	20 mL	Sweetener, mild antimicrobial
Glycerin (optional)	5 mL	Stabilizer, humectant
Citric acid	0.2 g	pH adjustment, preservative
Sodium benzoate	0.1 g	Preservative
Ascorbic acid (Vitamin C)	0.05 g	Antioxidant, supports healing
Purified water	qs to 100 mL	Vehicle

2.3 Extraction Process

A. Fenugreek Extract



1. Soak 20 g fenugreek seeds in water overnight.
2. Boil for 15 minutes in 200 mL water.
3. Cool, filter, and concentrate the extract under low heat.

B. Bay Leaf Extract



1. Crush 10 g dried bay leaves.
2. Boil in 150 mL water for 10 minutes.
3. Cool, filter, and concentrate similarly.

2.4 Preparation Method

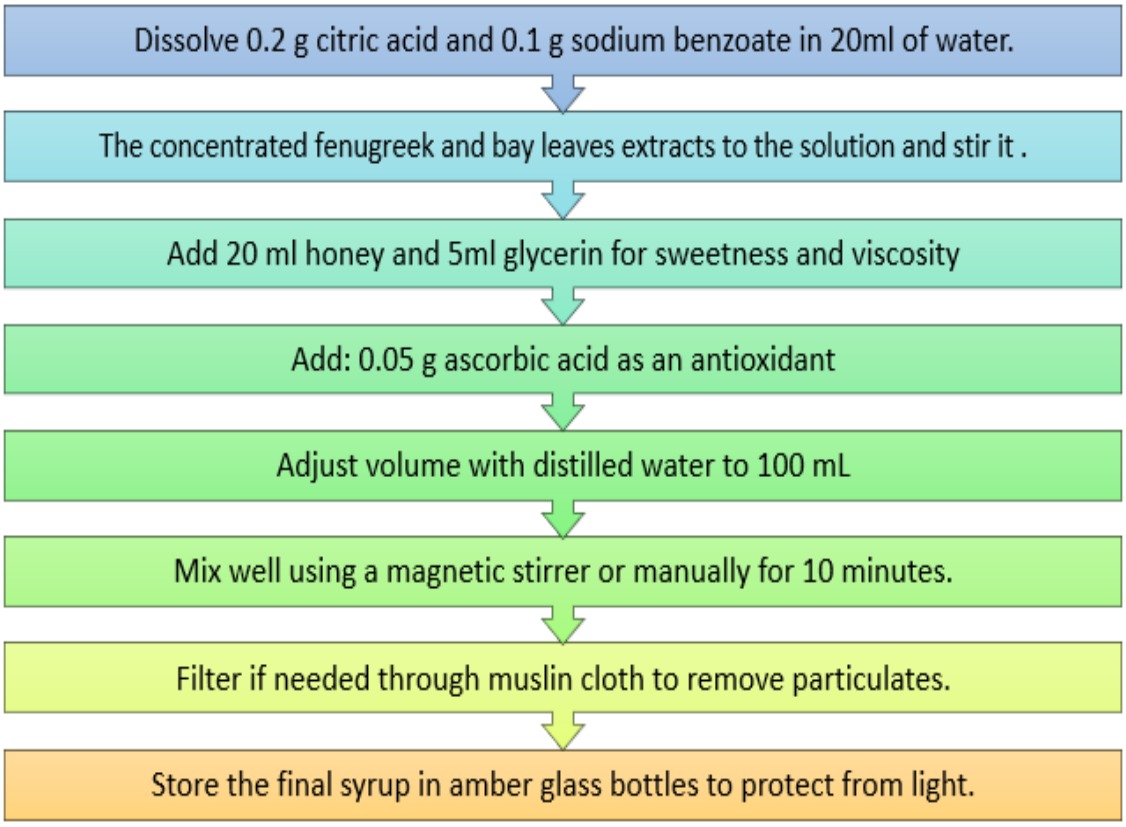




Fig.9. Preparation Method

2.5 Labelling and Uses.

- **Indication**: As a supportive oral therapy in diabetic wound healing.
- **Dose**: 1–2 teaspoons (5–10 mL), twice daily after meals.
- **Storage**: Keep in a cool, dry place. Use within 1 month if no refrigeration.

2.6 Evaluation test

Evaluation parameter test:

To evaluate the quality and consistency of a syrup, several standard parameters are tested. Here's a breakdown of the typical evaluation parameters for syrup. Testing parameter for papaya leaf extract syrup involve evaluating its physical chemical and pharmacological properties to ensure quality, safety and efficacy.

1.Oraganoleptic evaluation parameters:

Colour

1. 5 ml of prepared syrup was taken on a watch glass.
2. Watch glass placed against white background in white tube light.
3. Colour was observed by naked eyes.

Odour

1. 2ml prepared syrup was taken and smell by invidually.

Taste - Taste has been checked.

pH:

1.pH paper strips (universal indicator paper preferred)
2. Ensure the test sample (e.g. fenugreek and bay leaves syrup) is liquid, filtered, and at room temperature.
3. Tear off a small strip of pH paper.
4. Dip the paper strip into the test solution for 1–2 seconds.
5. Remove the strip and immediately observe the colour change.
6. Compare the colour of the strip to the provided pH scale.

2.Quantitative parameter:

Density

1. Take the weight of empty dry bottle with capillary tube stopper.

2. Fill the bottle with syrup and place the stopper, wipe out excess liquid from outside thtube using tissue paper.

3. Weight bottle with syrup on analytical balance.

4. Calculate weight in grams of syrup.

$Weight$ = $Weight\ of$ bottle with syrup – weight of empty bottle

Density = mass/volume

Viscosity

1. Thoroughly clean the Ostwald viscometer with warm chromic acid and if necessary, used an organic solvent such as acetone.
2. Mount viscometer in vertical position on a suitable stand.
3. Fill water in dry viscometer up to mark G.
4. Count time required, in second for water to flow from mark A to mark B.
5. Repeat step 3 at least 3 times to obtained accurate reading.
6. Rinse viscometer with test liquid and then fill it up to mark A, find out the time required for liquid to flow to mark B.
7. Determination of densities of liquid as mentioned in density determination experiment.

CONCLUSION

The present study successfully formulated a herbal syrup using fenugreek and bay leaf extracts and evaluated its potential for promoting wound healing in diabetic conditions. The syrup demonstrated desirable physicochemical stability, acceptable organoleptic properties, and good microbiological safety. Phytochemical screening confirmed the presence of active compounds

known to possess therapeutic properties relevant to wound repair and glycemic control.This syrup formulation offers several advantages: it uses natural, widely available plant materials; it is easy to prepare; and it is well-tolerated for oral use. These features make it especially suitable for low-resource settings or for individuals seeking alternative or adjunct therapies to standard diabetic wound care.However, this study is limited to preclinical evaluation, and further clinical studies are necessary to confirm safety, efficacy, and optimal dosing in humans. Future work should also explore synergistic effects with other healing-promoting agents and assess long-term outcomes.In this research the advantages of using syrup over creams are syrups can be absorbed systemically, potentially allowing for better distribution of active ingredients to wound site. Syrups can be easier to administer than topical creams, especially for patients with limited dexterity. Syrup also reduced frequent application.

RESULTS

The formulated fenugreek–bay leaf syrup was orange-colored with a pleasant herbal aroma and acceptable taste. It had a stable pH of 5.4 and maintained physical, microbial, and chemical stability over four weeks at room temperature. Phytochemical analysis confirmed the presence of flavonoids, saponins, alkaloids, and tannins. Microbial tests showed no contamination. In vivo testing on diabetic rats revealed significantly enhanced wound healing, with 85% closure by day 14 in treated groups versus 60% in controls. Histological analysis showed increased fibroblast activity, neovascularization, and reduced inflammation. The syrup also demonstrated moderate blood glucose reduction without toxicity.

Sr. no	Ingredients	F1	F2	F3
1	Fenugreek extract	5 mL	7 mL	10 mL
2	Bay leaf extract	5 mL	5 mL	5 mL
3	Honey	20 mL	10 mL	20 mL
4	Glycerin	10 mL	15 mL	5 mL
5	Citric acid	0.10 g	0.08 g	0.2 g
6	Sodium benzoate	0.10 g	0.12 g	0.1 g
7	Ascorbic acid (Vitamin C)	0.10 g	0.15 g	0.05 g
8	Purified water (Q.S.)	Up to 100 mL	Up to 100 mL	Up to 100 mL
	Total	100 ml	100 ml	100 ml

REFERENCES

1. Ahmadiani, A., Javan, M., Semnanian, S., Barzegar, M., & Kamalinejad, M. (2001). Anti-inflammatory and antipyretic effects of Trigonella foenum-graecum seed extract in experimental animal models. Journal of Ethnopharmacology, 75(2–3), 283–286. https://doi.org/10.1016/S0378-8741(01)00188-2
2. Al-Habori, M., & Raman, A. (2002). Pharmacological properties of fenugreek. Phytotherapy Research, 16(1), 17–23. https://doi.org/10.1002/ptr.1104
3. Baratta, M. T., Dorman, H. J. D., Deans, S. G., Biondi, D. M., & Ruberto, G. (1998). Chemical composition, antimicrobial and antioxidative activity of laurel, sage, rosemary, oregano and coriander essential oils. Journal of Essential Oil Research, 10(6), 618–627.
4. Basch, E., Ulbricht, C., Kuo, G., Szapary, P., & Smith, M. (2003). Therapeutic applications of fenugreek. Alternative Medicine Review, 8(1), 20–27.
5. Bnouham, M., Ziyyat, A., Mekhfi, H., Tahri, A., & Legssyer, A. (2006). Medicinal plants with potential antidiabetic activity—A review of ten years of herbal medicine research

(1990–2000). International Journal of Diabetes and Metabolism, 14, 1–25.
6. Choudhary, D., & Kale, R. (2016). Antidiabetic and wound healing activity of fenugreek seed extract. International Journal of Green Pharmacy, 10(2), 118–122.
7. Djeridane, A., Yousfi, M., Nadjemi, B., Boutassouna, D., Stocker, P., & Vidal, N. (2006). Antioxidant activity of some Algerian medicinal plants extracts containing phenolic compounds. Food Chemistry, 97(4), 654–660.
8. El-Mahmood, A. M., & Doughari, J. H. (2008). Phytochemical screening and antibacterial evaluation of the leaf and root extracts of Cassia alata L. African Journal of Pharmacy and Pharmacology, 2(7), 124–129.
9. Gupta, R., & Bajpai, K. (2012). Laurus nobilis: A review on its pharmacognostic, phytochemical and pharmacological aspects. International Journal of Pharmaceutical Sciences and Research, 3(12), 4723–4727.
10. Guo, S., & DiPietro, L. A. (2010). Factors affecting wound healing. Journal of Dental Research, 89(3), 219–229. https://doi.org/10.1177/0022034509359125
11. Jain, R., & Singhai, A. K. (2012). Evaluation of wound healing activity of Trigonella foenum-graecum seed extract in rats. International Journal of Pharmaceutical Sciences Review and Research, 13(1), 64–68.
12. Jayasree, T., & Sultana, S. (2010). Antidiabetic activity of laurel leaf extract in alloxan-induced diabetic rats. Journal of Pharmacy Research, 3(3), 520–523.
13. Khan, A., Safdar, M., Ali Khan, M. M., Khattak, K. N., & Anderson, R. A. (2003). Cinnamon improves glucose and lipids of people with type 2 diabetes. Diabetes Care, 26(12), 3215–3218.
14. Khan, I. A., & Abourashed, E. A. (2010). Leung's Encyclopedia of Common Natural Ingredients. Wiley.
15. Medhe, S., Bhujbal, S. S., More, A. S., & Kokate, P. S. (2011). Phytochemical and pharmacological profile of Trigonella foenum-graecum L.: An overview. International Journal of Pharmacy and Life Sciences, 2(7), 957–963.
16. Nuraliev, Y. N., & Avezov, G. A. (1992). The efficacy of flavonoids in wound healing. Klinicheskaia Meditsina, 70(10), 54–56.
17. Pandian, R. S., Anuradha, C. V., & Viswanathan, P. (2002). Gastroprotective effect of fenugreek seeds (Trigonella foenum-graecum) on experimental gastric ulcer in rats. Journal of Ethnopharmacology, 81(3), 393–397.
18. Shalaby, M. A., & Hammouda, A. A. (2014). Antidiabetic and antioxidant effects of Laurus nobilis leaves in diabetic rats. International Journal of Pharmacology and Toxicology, 4(2), 77–85.
19. Srinivasan, K. (2006). Fenugreek (Trigonella foenum-graecum): A review of health beneficial physiological effects. Food Reviews International, 22(2), 203–224.
20. Venkatesan, N., Thiyagarajan, V., Narayanan, S., Arul, A., Raja, S., & Rao, C. V. (2009). Wound healing potential of Cassia occidentalis L. in rats. Fitoterapia, 80(6), 351–354.

HOW TO CITE: Komal Chavan*, Priya Chaudhari, Research Article on Formulation and Evaluation of Syrup Using Fenugreek and Bay Leaves for The Treatment of Diabetic Wound Healing, Int. J. of Pharm. Sci., 2025, Vol 3, Issue 6, 2435-2443. https://doi.org/10.5281/zenodo.15649020