

Formulation and Evaluation of Tea Bags for Menstrual Health: Synergistic Effect of Fenugreek Seeds and Pomegranate Peels

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Abstract: This study aimed to formulate and evaluate herbal tea bags containing fenugreek (*Trigonella foenum-graecum*) and pomegranate (*Punica granatum*) for menstrual health support. The prepared formulations were assessed for physicochemical parameters such as weight variation, moisture content, pH, infusion time, and extractive value, along with organoleptic properties and stability studies. The results indicated that all parameters were within acceptable limits, confirming good quality and stability. The combination tea showed higher extractive value and better taste compared to fenugreek alone, indicating improved release of active constituents and enhanced palatability. The synergistic effect of both herbs suggests that the formulation is an effective, safe, and convenient natural remedy for managing menstrual disorders.

Keywords: Herbal tea bags, Menstrual health, Dysmenorrhea, Phytoconstituents, Herbal formulation, Antioxidant, Phytoestrogenic activity, Natural therapy

1. Introduction

The menstrual cycle is a regular bodily process that happens in females, usually taking around 28 days, though can be different for some people. It prepares the uterus for the possibility of pregnancy. The cycle has several stages: the follicular phase, where an egg develops; ovulation, when the egg is released; and the luteal phase, which readies the uterus for a fertilized egg. If the egg isn't fertilized, the lining of the uterus is shed, which is known as menstruation. This cycle is controlled by hormones that are regulated by the hypothalamus, pituitary gland, and ovaries, working together in a coordinated way to support reproductive health and fertility. Knowing about the menstrual cycle is important for understanding reproductive health and being aware of your body. (1) Menstrual health is a critical aspect of women's overall well-being, with a significant impact on their quality of life. Menstrual disorders, such as dysmenorrhea, irregular menstrual cycles, excessive bleeding, fatigue, and hormonal imbalance.

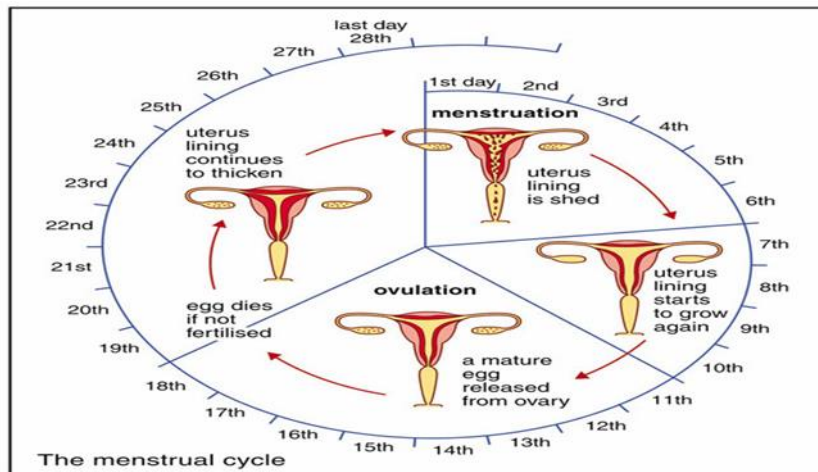


Fig No 1. Menstrual cycle

1) Dysmenorrhea (Painful Periods)

- Characterized by cramping, pain, and discomfort in the lower abdomen, back, and thighs during menstruation
- Can be primary (without an underlying medical condition) or secondary (due to an underlying condition such as endometriosis)

2) Irregular Menstrual Cycles

- Irregular periods can be caused by hormonal imbalances, stress, or underlying medical conditions
- Can lead to infrequent or prolonged menstrual bleeding, making it challenging to track fertility and plan for pregnancy

3) Excessive Bleeding (Menorrhagia)

- Heavy or prolonged menstrual bleeding can lead to:
- Iron deficiency anemia
- Fatigue
- Emotional distress

These menstrual disorders can significantly impact a woman's quality of life, and it's essential to seek medical attention if symptoms persist or worsen over time.

are common complaints, affecting a significant proportion of women worldwide. (2)

Conventional pharmacological treatments, including non-steroidal anti-inflammatory drugs (NSAIDs) and hormonal therapies, are often effective in managing menstrual disorders. However, these treatments can be associated with adverse effects, such as gastrointestinal side effects, weight gain, and increased risk of thrombosis, particularly with long-term use (3). The potential risks and side effects of conventional treatments have led to a growing interest in herbal and natural remedies that are safer, more cost-effective, and culturally acceptable.

Fenugreek (*Trigonella foenum-graecum*) is a medicinal plant that has been traditionally used to support female reproductive health. The plant's seeds contain a range of bioactive compounds, including phytoestrogens, flavonoids, saponins, and alkaloids, which may contribute to its therapeutic potential (4). Fenugreek has been shown to possess anti-inflammatory, antispasmodic, and estrogen-modulating properties, which may help regulate menstrual cycles, reduce menstrual pain, and improve hormonal balance (5).

Pomegranate (*Punica granatum*) is another medicinal plant that has been widely recognized for its antioxidant, anti-inflammatory, and estrogen-modulating properties. The peel and arils of the pomegranate fruit contain a range of

bioactive compounds, including polyphenols, tannins, and anthocyanins, which may help reduce menstrual pain, regulate bleeding, and improve uterine health (6).

Herbal tea bags offer a convenient and acceptable dosage form for delivering the therapeutic benefits of medicinal plants. Tea bags are easy to prepare, improve patient compliance, ensure accurate dosing, and preserve the bioactive compounds of herbal ingredients. The combination of fenugreek and pomegranate in a tea bag formulation may provide synergistic benefits for menstrual cycle regulation and relief from associated symptoms. (7)

2. Plant profile

1) Fenugreek (*Trigonella foenum-graecum L.*, Family: -Fabaceae)

➤ **Biological Source:** - Fenugreek consists of the dried seeds of *Trigonella foenum-graecum L.*, a cultivated annual herb.

➤ **Phytoconstituents Present in Fenugreek**

- Saponins
- Flavonoids
- Alkaloids
- Fiber
- Vitamins and Minerals (8)

➤ **Pharmacological Activity**

- Phytoestrogenic Activity
- Anti-dysmenorrheal Activity
- Anti-inflammatory Action
- Hormonal Modulatory Effect
- Antioxidant Activity
- Uterine Tonic Effect

➤ **Uses of fenugreek**

- Alleviates menstrual cramps (dysmenorrhea)
- Normalizes irregular menstrual flow
- Relieves PMS symptoms (fatigue, irritability, mood swings)
- Supports lactation and hormonal balance postpartum (9, 10).



Fig. No. 2.1 Fenugreek Seed

ripe

2) Pomegranate (*Punica granatum L.*, Family: -Lythraceae,) (11)

➤ **Biological source:** - Pomegranate consists of the fresh or dried fruits, fruit rind (peel), and seeds of *Punica granatum L.*

➤ **Phytoconstituents Present in pomegranate**

- Punicalagins
- Ellagic Acid
- Anthocyanins
- Flavonoids
- Punicic Acid



Fig. No 2.2 Pomegranate

➤ **Pharmacological Activity**

- Regulates hormonal balance
- Relieves menstrual cramps
- Reduces pelvic inflammation
- Antioxidant protection
- Manages anemia and fatigue
- Supports reproductive health

➤ **Uses in Menstrual Disorders**

- Corrects irregular menstruation (oligomenorrhea, amenorrhea)
- Reduces menstrual fatigue and iron deficiency
- Improves hormonal balance and reproductive health
- Acts as a uterine tonic (12,13)

Ginger (*Zingiber officinale*, Family: Zingiberaceae)

➤ **Biological**

Ginger consists of the dried rhizomes of *Zingiber officinale* Roscoe, belonging to the family Zingiberaceae. It is widely used as a spice and medicinal plant.(14)

Source:



Fig No 2.3 Ginger

➤ **Pharmacological Activities:**

- Anti-dysmenorrheal activity
- Anti-inflammatory action
- Antiemetic activity
- Antioxidant activity
- Hormonal modulatory effect
- Neurological (serotonin-modulating) effect (15)

➤ **Mechanism**

of

Action:

Gingerols inhibit cyclooxygenase (COX) and lipoxygenase (LOX) enzymes, thereby reducing prostaglandin (PGF₂α) production. This leads to decreased uterine contractions and relief from menstrual pain.(16)

➤ **Uses of Ginger**

- Alleviates menstrual cramps (dysmenorrhea)
- Reduces uterine spasms and inflammation
- Helps regulate irregular menstrual cycles
- Relieves PMS symptoms (fatigue, nausea, mood swings)
- Reduces bloating and abdominal discomfort
- Improves blood circulation during menstruation
- Acts as a digestive stimulant
- Relieves indigestion, gas, and bloating
- Helps in nausea and vomiting (including motion sickness and PMS-related nausea)(17)

3. Material and Equipment

❖ **Material**

- 1) Filter Paper (Tea Bag Paper) (21)
- 2) Thread and Tags
- 3) Fenugreek seeds: Dried and powdered
- 4) Pomegranate peel: Dried and powdered (22)
- 5) Ginger powder: For digestive benefits
- 6) Fennel seeds: For carminative properties (23)

❖ **Equipment**

- 1) Analytical Balance
- 2) Grinder or Pulveriser
- 3) Sieve (Mesh No. 40 or 60)
- 4) Hot Air Oven or Shade Drying Setup
- 5) Beakers and Glassware (24)
- 6) pH Meter

4. Methodology

1) Collection and Authentication of Plant Materials

Fenugreek seeds and pomegranate peel/arils were collected from a reliable source and authenticated based on their morphological characteristics as per standard herbal pharmacognosy references.

2) Preparation of Plant Materials

The fenugreek seeds were cleaned to remove foreign matter and shade dried. Pomegranate peels/arils were washed thoroughly, shade-dried, and then dried completely. The dried materials were pulverized separately using a grinder to obtain fine powders.(20)

3) Sieving of Powder

The powdered materials were passed through a mesh sieve (40–60) to obtain uniform particle size, which ensures proper infusion and extraction of active constituents during tea preparation.(22)

4) Formulation of Herbal Tea Bags

Accurately weighed quantities of fenugreek powder and pomegranate powder were mixed uniformly in suitable proportions. The blended powder was filled into filter paper tea bags, sealed properly, and tagged.

5) Evaluation of Herbal Tea Bags

- Weight variation
- Moisture content
- pH of infusion
- Infusion time
- Extractive value (23)

4. Formulation table

Table No. 1 Formulation For Combination Of Fenugreek–Pomegranate Herbal Tea Bags

Sr. No	Ingredient	Botanical Name	Quantity per Tea Bag (g)	Role in Formulation
1.	Fenugreek seeds (powdered)	Trigonella foenum-graecum	1.0 g	Regulates hormones, relieves menstrual cramps
2.	Pomegranate peel (dried & powdered)	Punica granatum	0.8 g	Antioxidant, anti-inflammatory, improves uterine health
3.	Ginger (optional)	Zingiber officinale	0.2 g	Enhances digestion, reduces pain
4.	Tea bag filter paper	-	q.s.	Packaging material

Total weight per tea bag: ~2.0–2.2 g.

Table No. 2 Formulation Table for Fenugreek powder Herbal Tea Bags

Sr. No.	Ingredient	Botanical Name	Quantity per Tea Bag (g)	Role in Formulation
1.	Fenugreek seeds (powdered)	Trigonella foenum-graecum	1.0 g	Helps regulate hormones, supports menstrual cycle regularity, relieves menstrual cramps, and improves digestion.
2.	Tea bag filter paper	—	q.s.	Used as packaging material to hold the herbal powder for infusion.

5. Evaluation tests for herbal tea bags

1) Weight Variation Test

Ten tea bags were selected randomly and weighed individually using an analytical balance. The average weight was calculated and the percentage deviation from the average was determined to ensure uniformity of dosage.

2) Moisture Content

The moisture content of the tea bags was determined by the loss on drying method. The sample was dried in a hot air oven at 105°C until a constant weight was obtained. Lower moisture content indicates better stability and reduced microbial growth.



Fig. No. 5.1 Loss On Drying

3) pH of Tea Infusion

One tea bag was infused in 100 ml of hot distilled water for 5 minutes. The pH of the prepared infusion was measured using a calibrated pH meter to ensure suitability for consumption.



Fig. No. 5.2 PH of comination tea infusion



Fig. No. 5.3 PH of fenugreek tea infusion

4) Infusion Time

Infusion time was determined by placing a tea bag in hot water and recording the time required for complete extraction of color, aroma, and soluble constituents.



Fig. No. 5.4 Fenugreek Tea Infusion Time



Fig. No. 5.5 Tea Infusion Time

5) Extractive Value

A known volume of the tea infusion was evaporated to dryness. The residue obtained was weighed and the extractive value was calculated as a percentage, indicating the amount of soluble active constituents.



Fig. No. 5.6 Fenugreek extractive value



Fig. No. 5.7 Combination extractive value

6) Organoleptic Evaluation

The prepared tea infusion was evaluated for sensory characteristics such as colour, Odor, taste, and overall acceptability by a panel of volunteers using standard organoleptic parameters.

Table No.3 Fenugreek and pomegranate combination tea bag

Parameter	Original (Powder Blend)	Result (Tea Infusion)
Colour	Brown to dark reddish-brown powder	Reddish-brown to amber coloured solution
Odour	Characteristic mixed odour (strong, slightly bitter fenugreek with mild fruity pomegranate note)	Mild aromatic, slightly fruity with a hint of bitterness
Taste	Bitter and slightly astringent	Mildly bitter with slight astringency and a pleasant aftertaste

Table No.4 Fenugreek powder tea bag

Parameter	Original (Powder)	Result (Tea Infusion)
Colour	Yellowish-brown powder	Light yellow to golden brown solution
Odour	Strong, characteristic, slightly bitter and maple-like smell	Mild aromatic, slightly bitter odour
Taste	Bitter and slightly pungent	Mildly bitter with a characteristic herbal taste

7) Appearance and Integrity

The tea bags were visually inspected for uniformity, sealing quality, absence of leakage, and overall physical appearance.

8) Stability Study

The formulated tea bags were stored in airtight containers at room temperature. Periodic evaluations were conducted to observe any changes in appearance, aroma, moisture content, and pH over time. (24)

6. Result and discussion

A. Results

The formulated herbal tea bags containing fenugreek and pomegranate were evaluated for various physicochemical, organoleptic, and stability parameters. The observations are summarized below:

Table 5 Results of fenugreek tea bag

Sr.No.	Parameter	Observation / Result	Interpretation
1.	Weight Variation	Uniform (within acceptable limits)	Ensures dose uniformity
2.	Moisture Content	Low	Good stability and shelf life
3.	pH of Infusion	4.94 – 6	Safe for consumption
4.	Infusion Time	~5 minutes	Efficient extraction
5.	Extractive Value	Moderate	Adequate release of phytoconstituents
6.	Colour (Infusion)	Light yellow to golden brown	Characteristic appearance
7.	Odour	Mild aromatic, slightly bitter	Acceptable
8.	Taste	Mildly bitter, herbal	Slightly less palatable
9.	Appearance	Uniform, well sealed	Good quality

Table 6 Results of fenugreek–pomegranate tea bag

Sr. No.	Parameter	Observation / Result	Interpretation
1.	Weight Variation	Uniform (within acceptable limits)	Ensures dose uniformity
2.	Moisture Content	Low	Good stability and shelf life
3.	pH of Infusion	4.52 – 6.5	Safe and slightly acidic
4.	Infusion Time	~5 minutes	Efficient extraction
5.	Extractive Value	High	Better release of active constituents

6.	Colour (Infusion)	Reddish-brown to amber	Improved visual appeal
7.	Odour	Mild aromatic with fruity note	More pleasant
8.	Taste	Mildly bitter with pleasant aftertaste	Better palatability
9.	Appearance	Uniform, properly sealed	Good quality

B. Discussion

The study successfully formulated and evaluated herbal tea bags containing fenugreek and pomegranate for menstrual health support. All physicochemical parameters were within acceptable limits, indicating good quality and stability. The combination tea showed higher extractive value and better organoleptic properties compared to fenugreek alone. Stability studies confirmed no significant changes during storage. Due to the synergistic effects of both herbs, the combination formulation was found to be more effective, palatable, and suitable as a natural remedy for menstrual disorders.

Conclusion

The study concludes that the formulated herbal tea bags containing fenugreek and pomegranate are a safe, effective, and convenient herbal dosage form for supporting menstrual health. The combination exhibits synergistic effects in regulating menstrual cycles, reducing pain, and improving overall reproductive well-being. The formulation showed satisfactory physicochemical properties, stability, and good organoleptic acceptability. This herbal tea can serve as a natural alternative to conventional therapies for menstrual disorders with minimal side effects. However, further clinical studies are recommended to validate its efficacy on a larger population.

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