Research Article

Development and Evaluation Of Herbal Candy As A Natural Remedy For Pain in Dysmenorrhea

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Abstract

Background: Dysmenorrhea is a common gynecological condition characterized by painful menstrual cramps that adversely affect the quality of life of women. Conventional therapies such as non-steroidal anti-inflammatory drugs (NSAIDs) provide symptomatic relief but may produce adverse effects with prolonged use. Herbal medicines offer a safer alternative due to their analgesic, anti-inflammatory, and antispasmodic properties.

Objective: To develop and evaluate a polyherbal candy as a natural remedy for the management of dysmenorrhea.

Materials and Methods: Powdered Zingiber officinale, Foeniculum vulgare, Cinnamomum verum, Curcuma longa, Trachyspermum ammi, and Prunus dulcis were used to make herbal candies. The molding procedure was used to create five formulations (F1–F5), which were then assessed for their organoleptic qualities, weight variation, hardness, friability, moisture content, pH, dissolving characteristics, stability, and analgesic action.

Results: All formulations exhibited acceptable physicochemical characteristics and stability. The optimized formulation demonstrated satisfactory hardness, low friability, suitable moisture content, and improved dissolution behavior. Analgesic evaluation revealed a significant reduction in pain response compared with the control group.

Conclusion: The developed polyherbal candy showed promising physicochemical properties and analgesic potential, suggesting its suitability as a patient-friendly herbal dosage form for the management of dysmenorrhea. Further clinical studies are required to confirm its therapeutic efficacy.

Keywords: Dysmenorrhea, Polyherbal Candy, Menstrual Pain, Analgesic Activity, Herbal Formulation, Jaggery-Based Dosage Form.

Introduction

Overview of Dysmenorrhea

One of the most prevalent gynecological conditions affecting teenage girls and women of reproductive age globally is dysmenorrhea. [1] It is characterized by severe uterine cramps that happen either before or during menstruation, and it is frequently accompanied by symptoms including headache, nausea, vomiting, exhaustion, diarrhoea, and lower back discomfort.[2] Daily activities, academic achievement, professional output, and general quality of life can all be severely hampered by the illness.[3]

The prevalence of dysmenorrhea among women of reproductive age has been found to range from 16% to 91%, according to epidemiological studies. Between 2% and 29% of women experience severe dysmenorrhea that interferes with daily activities.[4] The primary causes of the large range in prevalence are variations in study populations, diagnostic standards, and evaluation techniques.[5]

Risk Factors Associated with Dysmenorrhea

The frequency and intensity of dysmenorrhea are influenced by a number of factors. Reduced symptom prevalence and severity are typically linked to increasing age and plurality. Because oral contraceptives suppress ovulation and lower prostaglandin production, women who use them frequently have less menstrual pain.[6] On the other hand, good family history and psychological stress have been found to be significant risk factors. There is still conflicting data on smoking, obesity, food, depression, and other lifestyle issues.[7]

Signs and Symptoms

The main symptom of dysmenorrhea is lower abdominal cramps, which typically start just before or at the start of menstruation and are most severe during the first 24 to 48 hours of menstrual flow.[8] The thighs, pelvis, and lower back

might all be affected. Nausea, vomiting, diarrhea, bloating in the abdomen, headaches, lightheadedness, exhaustion, and widespread weakness are frequently associated symptoms.[9] There may also be psychological symptoms like irritation, anxiety, mood swings, and diminished focus. The intensity of the symptoms ranges from minor discomfort to crippling pain that substantially interferes with day-to-day activities.[10]

Classification of Dysmenorrhea

Dysmenorrhea is classified into primary and secondary forms.

Primary Dysmenorrhea

When painful menstruation occurs without any discernible pelvic pathology, it is referred to as primary dysmenorrhea. It usually appears in adolescence with the onset of ovulatory cycles and is mostly linked to increased prostaglandin production, which causes ischemic pain and excessive uterine contractions.[11]

Secondary Dysmenorrhea

Secondary dysmenorrhea occurs due to underlying pelvic disorders such as endometriosis, adenomyosis, uterine fibroids, pelvic inflammatory disease, ovarian cysts, or structural abnormalities of the reproductive tract. Unlike primary dysmenorrhea, symptoms may persist beyond menstruation and often require treatment of the underlying pathology.[12]

Pathophysiology of Dysmenorrhea

The overproduction of prostaglandins, especially prostaglandin F2α, after progesterone withdrawal during menstruation is the main cause of dysmenorrhea.[13] Strong uterine contractions, vasoconstriction, decreased uterine blood flow, and tissue ischemia are all brought on by elevated prostaglandin levels, which cause cramping pain. Leukotrienes, vasopressin, and inflammatory cytokines are additional mediators that contribute to the production of pain and uterine hypercontractility. Additionally, recent research points to the central nervous system's role in the perception and processing of pain.[14]

Conventional Treatment and Its Limitations

Hormonal contraceptives and non-steroidal anti-inflammatory medicines (NSAIDs) are frequently used to treat dysmenorrhea. NSAIDs (Non-Steroidal Anti-Inflammatory Drugs) relieve menstruation pain by reducing prostaglandin synthesis and inhibiting cyclooxygenase enzymes.[15] However, long-term use may be linked to cardiovascular risks, nausea, dyspepsia, peptic ulcers, gastrointestinal irritation, and inadequate pain management in certain patients. Repeated monthly injection may also lower long-term patient compliance.[16]

Role of Herbal Medicine in Dysmenorrhea

Herbal remedies are becoming more popular as safer substitutes for conventional treatments because of their shortcomings.[17] Flavonoids, phenolic compounds, terpenoids, alkaloids, and essential oils are examples of bioactive components found in medicinal plants that have analgesic, anti-inflammatory, antispasmodic, antioxidant, and hormone-modulating properties. Compared to synthetic drugs, herbal formulations may offer multi-targeted therapeutic benefits with fewer side effects.[18]

Materials and Methods

Materials

Based on their proven analgesic, anti-inflammatory, antispasmodic, antioxidant, and nutritional qualities that are helpful in the treatment of dysmenorrhea, the herbal constituents were chosen for the polyherbal candy formulation. Ginger (Zingiber officinale), fennel (Foeniculum vulgare), cinnamon (Cinnamomum verum), turmeric (Curcuma longa), ajwain (Trachyspermum ammi), and almond (Prunus dulcis) were procured from a local market in Malkapur, Maharashtra, India. Jaggery served as the base for the candy. After being cleaned and authenticated, every ingredient was used to make the polyherbal candies.[19-25]

Table 1: Materials Selected for Preparation of Polyherbal Candy[19-25]

Sr. No.	Ingredients	Botanical Name	Family	Parts Used	Therapeutic Role
1	Ginger	Zingiber officinale	Zingiberaceae	Rhizome	Analgesic, Anti-inflammatory

2	Fennel	Foeniculum vulgare	Apiaceae	Seeds	Antispasmodic, Carminative
3	Cinnamon	Cinnamomum verum	Lauraceae	Bark	Anti-inflammatory, Antioxidant
4	Turmeric	Curcuma longa	Zingiberaceae	Rhizome	Analgesic, Anti-inflammatory
5	Ajwain	Trachyspermum ammi	Apiaceae	Seeds	Antispasmodic, Digestive Aid
6	Almond	Prunus dulcis	Rosaceae	Seeds	Nutritional Supplement, Antioxidant
7	Jaggery	-	-	-	Natural Sweetening and Binding Agent
8	Water	-	-	-	Solvent

Formulation Design

Five formulations (F1–F5) of polyherbal candy were prepared by varying the concentration of herbal ingredients while maintaining the required quantity of jaggery as the base material. The formulations were designed to evaluate the effect of varying herbal concentrations on the physicochemical properties and analgesic activity of the prepared candies. The composition of the formulations is presented in Table 2.

Table 2: Formula for Herbal Candy

Ingredient	F1 (g)	F2 (g)	F3 (g)	F4 (g)	F5 (g)
Jaggery (Gur)	35.0	34.0	33.0	34.5	35.5
Ginger powder	3.0	3.5	4.0	2.5	2.5
Turmeric powder	1.5	1.5	1.0	2.0	1.0
Ajwain powder	2.5	2.0	2.0	2.5	2.0
Fennel powder	2.5	2.0	2.0	2.0	2.5
Almond powder	1.0	1.0	1.0	1.0	0.5
Cinnamon powder	0.5	0.5	0.5	0.5	0.5
Water	q.s. (10–15 mL)				

Total	45 g	45 g	45 g	45 g	45 g

Experimental Work

1. Procurement and Authentication of Raw Materials

The herbal ingredients, namely ginger (Zingiber officinale), fennel (Foeniculum vulgare), cinnamon (Cinnamomum verum), turmeric (Curcuma longa), ajwain (Trachyspermum ammi), almond (Prunus dulcis), and jaggery were procured from the local market of Malkapur, Maharashtra, India. The materials were cleaned and authenticated by botanist from the department of Botony from nearby science college.

2. Preparation of Herbal Powder Blend

The selected herbal materials were cleaned to remove extraneous matter and dried under suitable conditions. The dried materials were powdered separately using a grinder and passed through an appropriate sieve to obtain uniform particle size. The powders were accurately weighed and mixed thoroughly to obtain a homogeneous polyherbal blend.

3. Preparation of Polyherbal Candy

The polyherbal candy was prepared by the heating and molding method. Accurately weighed jaggery was transferred into a stainless-steel vessel and heated gently with continuous stirring until a uniform syrup was formed. The temperature of the syrup was carefully maintained until the desired candy consistency was achieved. The previously prepared polyherbal blend was gradually incorporated into the molten jaggery mass with continuous stirring to ensure uniform distribution of herbal ingredients throughout the formulation. The mixture was stirred continuously until a homogeneous mass was obtained. The prepared mass was immediately poured into suitable molds and allowed to cool at room temperature. After complete solidification, the candies were removed from the molds and stored in airtight containers for further evaluation.[26]

4. Storage of Prepared Candy

The prepared polyherbal candies were packed in airtight containers and stored at room temperature in a dry place until further physicochemical evaluation, dissolution studies, stability studies, and analgesic activity assessment.

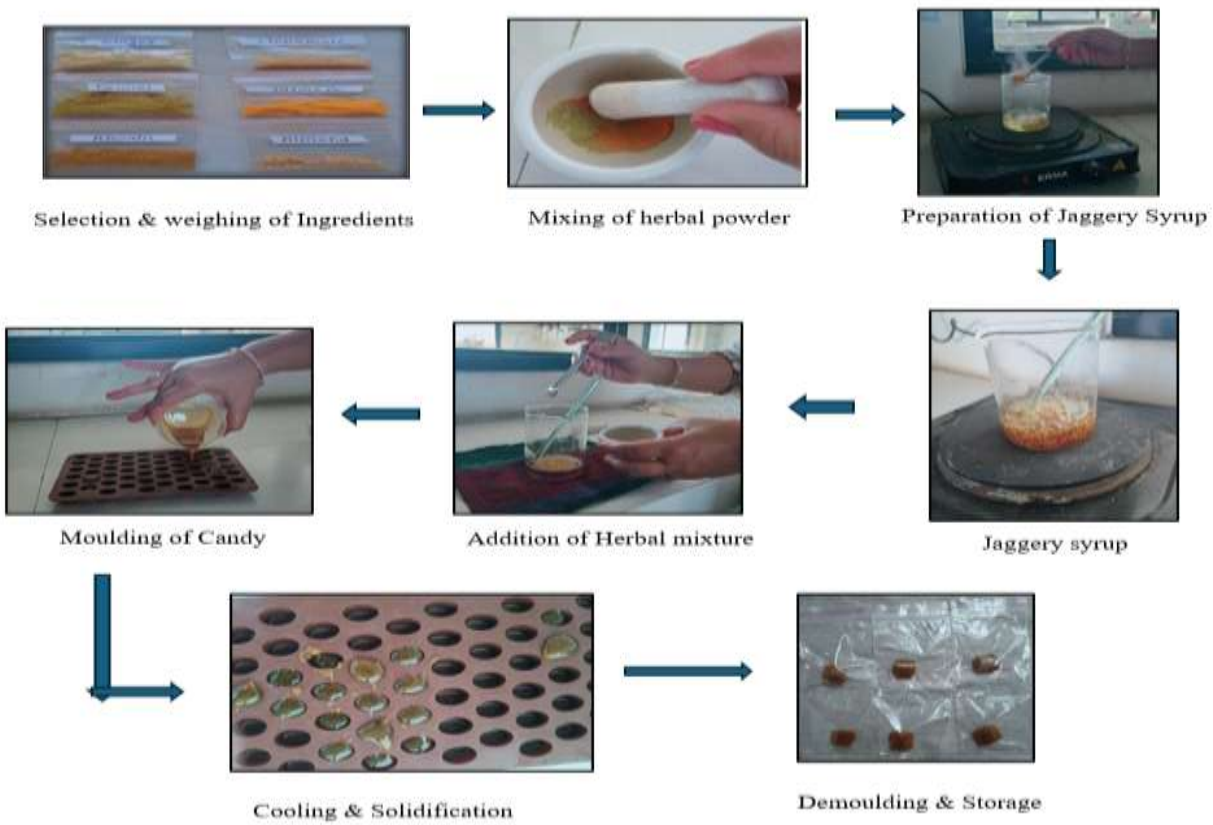

Figure 1: Preparation of Herbal Candy

Evaluation of Polyherbal Candy

1. Organoleptic Evaluation

The prepared polyherbal candies were evaluated visually for color, appearance, odor, taste, texture, and overall acceptability. [27]

2. Hardness Test

The hardness or crushing strength (Fo) of the prepared candies was determined using a hardness tester and expressed in kg/cm². [28]

3. Weight Variation

Twenty candies from each formulation were individually weighed using a digital balance, and the average weight was calculated to determine weight uniformity. [29]

4. Friability Test

Friability was determined by using Roche friabilator operated at 25 rpm for 4 min. The percentage weight loss after rotation was calculated to assess mechanical strength. [30]

5. Dissolution Study

The dissolution study was carried out using a USP Type 2 (paddle apparatus) under specified experimental conditions. Samples were withdrawn at predetermined time intervals and analyzed for cumulative drug release. [31]

6. pH Determination

The pH of the herbal candy was determined by dissolving 1 g of candy in 100 mL of distilled water and measuring the pH using a pH meter. An acceptable pH range for herbal candies is generally 5.5–7.5, indicating suitable stability and palatability of the formulation. [32]

7. Moisture Content

The percentage moisture content of the prepared candies was calculated using the loss-on-drying method. and the weight loss was computed as the candy's moisture content. This technique was used in order to prevent direct heating from melting or caramelizing the candy. [33]

8. Disintegration Study

The time required for complete disintegration of the candy in a suitable medium was recorded and expressed in minutes. [34]

9. Stability Study

The stability studies for candy were performed for the optimized candy formulation (F5) was subjected to stability testing at 40°C for 30 days as per ICH guidelines and evaluated for hardness, weight variation, moisture content, and drug release at the end of the study period.[35]

10. Pharmacological Evaluation of Herbal Candy

- Analgesic activity of herbal candy was evaluated using the acetic acid-induced writhing method.
- Female rats were selected for study.
- Animals were divided into 4 groups:

1. Control
2. Standard
3. Test (Candy 200 mg)
4. Test (Candy 400 mg)

- The number of writes was recorded for each animal
- % inhibition was calculated to determine the analgesic effect.[36]

Figure 2: Experimental Procedure for Analgesic Activity in Female Rats

Result & Discussion

Physicochemical Evaluation

Table 3: Physical Characteristics of Herbal Candy

Parameter	Observation
1. Appearance	Uniform, smooth surface
2. Color	Brown
3. Odor	Pleasant, characteristic herbal
4.Texture	Hard, non-sticky
5. Homogeneity	Uniform distribution of ingredients

Table 4: Physicochemical Evaluation of Herbal Candy Formulations (F1–F5)

Batches	Hardness (kg/cm^2)	Weight (g)	Friability (%)	Moisture Content (%)	Disintegration Time (min)
F1	4.5	3.01	0.44	3.2	8.4
F2	4.8	3.03	0.40	3.5	7.4
F3	4.6	3.02	0.42	2.8	7.8
F4	4.3	2.99	0.51	3.9	8.8
F5	4.9	3.04	0.37	3.1	7.2

Dissolution Study

Table 5: Percentage Cumulative Drug Release of Herbal Candy (F5)

Time (Min)	Drug Release (%)
0 Min	0.00
5 Min	16.80
10 Min	31.45
15 Min	46.20
20 Min	61.75
25 Min	82.40

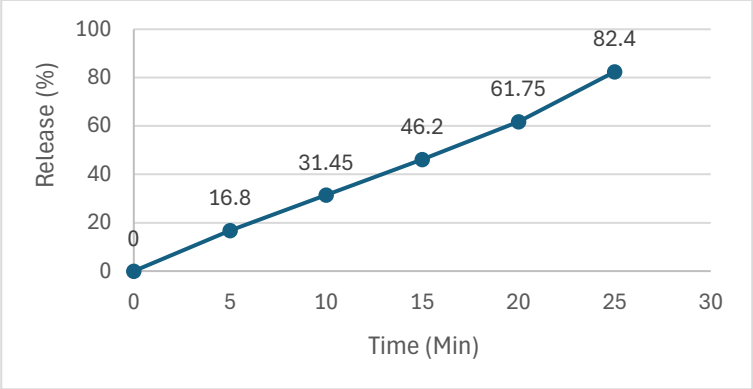

Figure 3: Time vs. % Drug Release of Herbal Candy (F5)

Organoleptic Evaluation

Table 6: Sensory Evaluation of Herbal Candy

Sr. No.	Parameter	Observation
1.	Taste	Sweet with mild pungency
2.	Odor	Pleasant herbal
3.	Mouthfeel	Smooth, non-irritant
4.	Overall Acceptability	Good

Stability Study (30 Days)

Table 7: Stability Evaluation of Herbal Candy

Parameter	Initial	After 30 Days
Color	Brown	No change
Taste	Acceptable	No change
Texture	Hard	No change
pH	6.0	6.1
Hardness	4.8	4.7

Analgesic Activity of Herbal Candy by Writhing Method

Table 8: Effect of Herbal Candy on Writhing Count and Percentage Inhibition in Experimental Animals

Animal group	Writhing Count						Avg Writhing	% Inhibition
	M1	M2	M3	M4	M5	M6		

Control	23	24	22	25	23	24	23.5	0
Standard	8	9	7	8	9	8	8.16	65
Candy (200 mg)	20	21	19	18	20	19	19.5	17
Candy (400 mg)	14	15	13	12	14	13	13.5	42

Graphical Representation of Analgesic Activity.

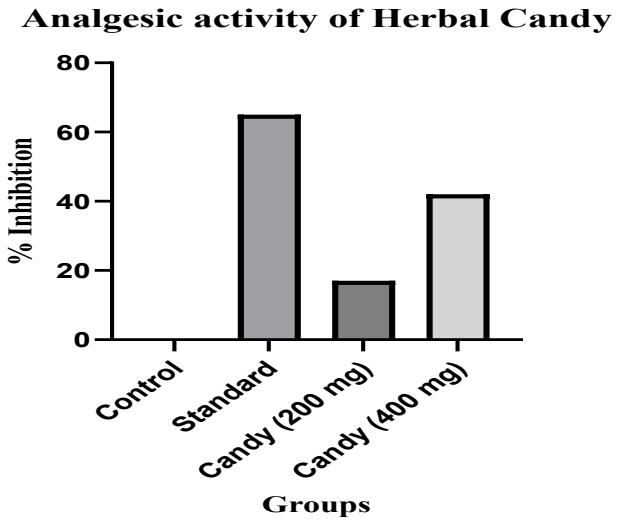

Figure 4: Comparison of Percentage Inhibition Among Control, Standard, and Herbal Candy Treated Groups

Conclusion

The present study successfully developed and evaluated a jaggery-based polyherbal candy containing ginger, fennel, cinnamon, turmeric, ajwain, and almond for the management of dysmenorrhea. The prepared formulations exhibited satisfactory physicochemical characteristics, including acceptable hardness, friability, moisture content, stability, and dissolution behavior. Among all formulations, F5 was identified as the optimized formulation due to its superior overall performance. The analgesic activity study demonstrated a significant reduction in pain response, suggesting the potential effectiveness of the polyherbal candy in relieving dysmenorrhea-associated pain. The developed formulation offers a palatable, convenient, and patient-friendly herbal dosage form that may serve as a natural alternative for the management of menstrual discomfort. Further clinical studies are recommended to establish its therapeutic efficacy and safety in human subjects.

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Conflict of Interest

The authors declare no conflict of interest.

Ethics Statement

All animal experiments were conducted in accordance with the guidelines of the Ethics Committee (IAEC) of Dr. Rajendra
Gode College of Pharmacy, Malkapur, Maharashtra, India. (protocol No. 1336/2025). This research did not involve human participants.

Informed Consent Statement

This study did not involve human participants, and therefore, informed consent was not required.

Clinical Trial Registration

This research does not involve any clinical trials.

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