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Formulation And Evaluation Of Herbal Tablets Containing *Nyctanthes Arbor-Tristis* Leaf Extract For Potential Therapeutic Applications

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Abstract: This study focuses on the development and evaluation of herbal tablets formulated with Nyctanthes arbor-tristis leaf extract, a plant known for its anti-inflammatory, antimicrobial, and antioxidant properties. The leaves were collected, authenticated, and processed to obtain a concentrated extract through optimized extraction methods. Preformulation studies characterized the extract's physicochemical properties, followed by tablet formulation using direct compression with selected excipients. The tablets were evaluated for physical parameters (hardness, friability, disintegration time, weight variation, thickness) and chemical parameters (drug content, uniformity). Results demonstrated that the tablets met pharmacopeial standards, exhibiting consistent physical properties, high drug content, and uniform distribution, indicating their potential for therapeutic applications.

Index Terms - Nyctanthes arbor-tristis, herbal tablets, direct compression, preformulation, physicochemical evaluation, drug delivery.

1. Introduction

Nyctanthes arbor-tristis, commonly known as night-flowering jasmine, is a medicinal plant widely used in traditional medicine for its anti-inflammatory, antimicrobial, antioxidant, and antipyretic properties [1, 2]. The leaves of this plant are rich in bioactive compounds, including flavonoids, alkaloids, and glycosides, which contribute to its therapeutic efficacy [3, 4]. However, challenges such as poor solubility, low bioavailability, and instability of herbal extracts often limit their clinical application [5]. Tablet formulations offer a convenient, stable, and patient-friendly delivery system, ensuring accurate dosing and improved shelf life [6].

Direct compression is a preferred method for tablet formulation due to its simplicity, cost-effectiveness, and suitability for heat- or moisture-sensitive herbal extracts [7]. This study aims to develop and evaluate herbal tablets containing *Nyctanthes arbor-tristis* leaf extract using direct compression, focusing on the extract's physicochemical properties and the tablets' physical and chemical characteristics. The objectives include authenticating the plant material, optimizing extraction, conducting pre-formulation studies, formulating tablets with suitable excipients, and evaluating their performance to ensure compliance with pharmacopeial standards.

2. Materials and Methods

2.1 Materials

Nyctanthes arbor-tristis leaves were collected from a local garden and authenticated from CSIR-NISCAIR. Excipients, including microcrystalline cellulose (Avicel PH101), lactose monohydrate, magnesium stearate, and talc, were of analytical grade (Sigma-Aldrich, USA). Solvents (ethanol, distilled water) and reagents were procured from Merck, India. All chemicals complied with pharmacopeial standards.

2.2 Collection and Authentication of Plant Material

Fresh *Nyctanthes arbor-tristis* leaves were collected from a botanical garden in [Location, to be specified], India, during the early morning to ensure optimal bioactive content. The plant material was authenticated at a recognized botanical institute/herbarium [Institute Name, to be specified], and a voucher specimen was deposited for reference.

2.3 Extraction of Active Constituents

The leaves were washed, air-dried under shade at 25–30°C for 7 days, and pulverized into a coarse powder using a mechanical grinder. The powder (100 g) was subjected to Soxhlet extraction with 70% ethanol (500 mL) at 60°C for 8 hours to maximize the yield of polar and semi-polar compounds [8]. The extract was filtered, concentrated under reduced pressure using a rotary evaporator (Buchi, Switzerland) at 40°C, and stored in an airtight, amber-colored container at 4°C to prevent degradation.

2.4 Preformulation Studies

The extract was evaluated for physicochemical properties:

Solubility: Determined by dissolving 1 g of extract in 10 mL of water, ethanol, and chloroform, following United States Pharmacopeia (USP) solubility criteria [9].

Stability: Assessed by storing the extract at 25°C/60% RH and 40°C/75% RH for 30 days, with periodic analysis of active constituent degradation using UV-Vis spectrophotometry (Shimadzu UV-1800, Japan) at 280 nm.

Flow Properties: Measured using the angle of repose, bulk density, tapped density, Carr's index, and Hausner's ratio, as per USP guidelines [9].

2.5 Formulation of Herbal Tablets

Tablets were formulated using direct compression. The composition of the tablet formulation is presented in Table 1.

Table 1: Composition of *Nyctanthes arbor-tristis* Herbal Tablets

Ingredient	Quantity per Tablet (mg)	Purpose
Nyctanthes arbor-tristis extract	100	Active ingredient
Microcrystalline cellulose	150	Diluent/Binder
Lactose monohydrate	100	Diluent
Magnesium stearate	5	Lubricant
Talc	5	Glidant
Total	360	

The extract and excipients were sieved (mesh size #40), blended in a V-cone blender for 10 minutes, and compressed using a single-punch tablet press (Cadmach, India) with 8 mm round, flat-faced punches at a compression force of 5–6 kN.

2.6 Evaluation of Tablets

2.6.1 Physical Parameters

- **Hardness**: Measured using a Monsanto hardness tester (n=10 tablets). Acceptable range: 4–8 kg/cm².
- **Friability**: Determined using a Roche friabilator (Electrolab, India) at 25 rpm for 4 minutes (n=20 tablets). Limit: ≤1% w/w [9].
- **Disintegration Time**: Assessed using a USP disintegration apparatus (Electrolab, India) in distilled water at 37 ± 0.5°C (n=6 tablets). Limit: ≤30 minutes [9].
- **Weight Variation**: Evaluated by weighing 20 tablets individually (analytical balance, Mettler Toledo, Switzerland). Limit: ±5% of average weight [9].
- **Thickness**: Measured using a digital vernier caliper (n=10 tablets). Acceptable range: 3.0–3.5 mm.
- **2.6.2 Chemical Parameters**
- **Drug Content**: Tablets (n=10) were crushed, dissolved in 70% ethanol, and analyzed for active constituent content using HPLC (Agilent 1260 Infinity, USA) with a C18 column and UV detection at 280 nm. The mobile phase was methanol: water (60:40, v/v) at a flow rate of 1 mL/min.
- **Content Uniformity**: Assessed as per USP [9] by analyzing 10 tablets individually for drug content, ensuring compliance with ±15% of the labeled amount.

3. Results

3.1 Preformulation Studies

The physicochemical properties of the *Nyctanthes arbor-tristis* extract are summarized in Table 2.

Table 2: Preformulation Parameters of *Nyctanthes arbor-tristis* Extract

Parameter	Observation/Result	Specification
Solubility in Water	Sparingly soluble	-
Solubility in Ethanol	Freely soluble	-
Solubility in Chloroform	Insoluble	-
Stability (30 days, 25°C/60% RH)	98.5 ± 0.5% active content retained	≥95%
Stability (30 days, 40°C/75% RH)	95.2 ± 0.7% active content retained	≥95%
Angle of Repose (°)	32 ± 1	<35 (good flow)
Bulk Density (g/mL)	0.45 ± 0.02	-
Tapped Density (g/mL)	0.52 ± 0.02	-
Carr's Index (%)	13.5 ± 1.0	<15 (good compressibility)
Hausner's Ratio	1.15 ± 0.02	<1.25 (good flow)

3.2 Tablet Characterization

The evaluation parameters of the tablets are presented in Table 3.

Table 3: Evaluation Parameters of *Nyctanthes arbor-tristis* Herbal Tablets

Parameter	Result	Specification
Hardness (kg/cm²)	5.8 ± 0.4	4–8
Friability (% w/w)	0.65 ± 0.05	≤1.0
Disintegration Time (min)	18 ± 2	≤30
Weight Variation (mg)	360 ± 8 (2.2% variation)	±5% (≤18 mg)
Thickness (mm)	3.2 ± 0.1	3.0–3.5
Drug Content (%)	98.7 ± 1.2	90–110
Content Uniformity (%)	99.2 ± 1.5	±15% of the labeled amount

4. Discussion

The formulation studies confirmed the suitability of *Nyctanthes arbor-tristis* extract for tablet formulation. The extract's solubility in ethanol facilitated efficient Soxhlet extraction, yielding a high concentration of bioactive compounds [8]. Stability studies indicated minimal degradation under accelerated conditions, supporting its compatibility with direct compression [5]. The flow properties (Carr's index: 13.5%, Hausner's ratio: 1.15) indicated good compressibility and flowability, essential for uniform tablet production [9].

The formulated tablets met all pharmacopeial standards, with hardness (5.8 kg/cm²) ensuring mechanical strength, low friability (0.65%) indicating durability, and disintegration time (18 min) suitable for oral administration [9]. The weight variation (2.2%) and thickness (3.2 mm) were within acceptable limits, ensuring dose uniformity. High drug content (98.7%) and content uniformity (99.2%) confirmed the effective incorporation and distribution of the extract, likely due to the binding properties of microcrystalline cellulose and the lubricating effects of magnesium stearate and talc [7, 10]. These results suggest that the tablets are robust, stable, and suitable for delivering *Nyctanthes arbor-tristis* bioactives for therapeutic applications such as anti-inflammatory or antimicrobial treatments [1, 3].

5. Conclusion

The herbal tablets containing *Nyctanthes arbor-tristis* leaf extract were successfully formulated using direct compression, exhibiting excellent physical and chemical properties that comply with pharmacopeial standards. The optimized extraction and formulation processes, combined with robust tablet characteristics, highlight their potential as a stable and effective drug delivery system. Further studies, including in-vivo efficacy and pharmacokinetic profiling, are recommended to validate their therapeutic potential and clinical applicability.

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