Development and Therapeutic Evaluation of Herbal Tablets Containing *Oroxylum indicum* Extract for the Management of Diarrhea and Dysentery

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ABSTRACT

This study centers on the development and assessment of herbal tablets incorporating *Oroxylum indicum* extract for the management of diarrhea and dysentery. Known as the Indian trumpet tree, *Oroxylum indicum* has a long-standing role in Ayurvedic medicine due to its beneficial effects on digestive health. Its bark, leaves, and seeds contain various bioactive compounds—including flavonoids, tannins, and alkaloids—that exhibit anti-inflammatory, antimicrobial, antispasmodic, and antidiarrheal activities. These properties not only relieve symptoms but also target the underlying causes of intestinal infections and inflammation. The tablet formulation includes carefully selected excipients to achieve desirable characteristics such as good flow, compressibility, rapid disintegration, and stability. While preclinical findings support the therapeutic potential of *Oroxylum indicum* in treating gastrointestinal conditions, further clinical research is necessary to confirm its safety and effectiveness in humans. Overall, this herbal formulation presents a natural, safe, and promising alternative or complementary treatment option for diarrhea and dysentery.

Keywords: Ayurvedic, Bioactive, Inflammation, Gastrointestinal, Anti diarrheal.

1. INTRODUCTION

Worldwide, diarrhea and dysentery continue to be major public health issues, especially in poor nations with inadequate access to clean water and medical care. These gastrointestinal conditions cause significant economic and social costs in addition to high rates of morbidity and mortality, particularly in youngsters (1). Despite their widespread usage, traditional pharmaceutical therapies including antibiotics and antidiarrheal medications are frequently linked to adverse effects, the possibility of antibiotic resistance, and restricted accessibility in rural regions (1,2).

In recent times, there has been a rising interest in traditional medicinal plants as alternative or supportive treatments for gastrointestinal ailments. *Oroxylum indicum*, also known as the Indian trumpet tree, is one such plant with a rich history in Ayurvedic medicine. Its bark, leaves, and seeds have long been used for their anti-inflammatory, antimicrobial, and gut-protective benefits (3).

Phytochemical investigations of *Oroxylum indicum* have identified various bioactive constituents, including flavonoids (such as baicalein and chrysin), tannins, and alkaloids, which are believed to play a role in its therapeutic potential against intestinal infections. Experimental studies have shown that the plant possesses antidiarrheal, antispasmodic, and antimicrobial properties, reinforcing its traditional use in managing conditions like diarrhea and dysentery (4,5).

Oroxylum indicum

Widely referred to as the Indian trumpet tree or broken bones tree, *Oroxylum indicum* is a flowering plant belonging to the Bignoniaceae family. It is indigenous to tropical areas of Asia, such as India, Southeast Asia, and regions of Indonesia and Malaysia. The tree is well-known for its therapeutic, ecological, and cultural importance (3,6).

Morphology and Characteristics

Oroxylum indicum is distinct in appearance, featuring a characteristic umbrella-like canopy, broad pinnate leaves, and eye-catching, bell-shaped purple blooms. It can reach a height of 12 to 15 meters, and its elongated, flat, sword-shaped seed pods have led to its nickname "Midnight Horror." Almost every part of the plant—including the roots, bark, leaves, seeds, and flowers—is utilized for its medicinal benefits (2,7).

Fig no.1 Morphology of *Oroxylum indicum*

BACKGROUND

Diarrhea and dysentery are among the most widespread gastrointestinal conditions, particularly affecting populations in low- and middle-income nations, where they are major contributors to illness and death—most notably in children under the age of five. Diarrhea typically involves the frequent passage of loose or watery stools, commonly triggered by infections from bacteria, viruses, or parasites (5,9). Dysentery, a more acute form of diarrhea, is marked by intestinal inflammation and the presence of blood or mucus in the stool, often linked to pathogens like *Shigella* species or *Entamoeba histolytica (8)*.

Conventional treatment methods include oral rehydration solutions, antibiotics, and medications that relieve intestinal spasms. However, concerns about antibiotic resistance, side effects, and limited access to modern medicines have spurred growing interest in herbal and plant-based remedies. Traditional healing systems such as Ayurveda offer a wealth of herbal treatments for digestive disorders (6,9).

Oroxylum indicum, known as the Indian trumpet tree or “Shyonaka” in Ayurvedic texts, is a deciduous plant indigenous to regions of South and Southeast Asia. It has long been used in traditional medicine to manage various health conditions, including gastrointestinal issues like diarrhea and dysentery, as well as respiratory and inflammatory disorders. The plant’s stem bark, roots, and fruits are particularly valued for their medicinal qualities (10).

Scientific research has validated many of these traditional uses, revealing that *Oroxylum indicum* possesses a broad spectrum of pharmacological activities, such as antimicrobial, anti-inflammatory, antidiarrheal, and antioxidant effects. Key phytochemicals in the plant, including baicalein, chrysin, and oroxylin A, are believed to be instrumental in regulating bowel movements, easing inflammation, and fighting infections. These properties reinforce its traditional application in treating intestinal diseases (11).

2. Role of Selected Drug in the Formulation of Tablet

a) *Oroxylum indicum*

Oroxylum indicum, also referred to as the Indian trumpet tree or "Midnight Horror," is a medicinal plant native to the tropical regions of Asia. It is easily recognized by its unique umbrella-like crown, large feather-shaped leaves, and vibrant purple, bell-shaped flowers. Widely used in Ayurvedic medicine, almost every part of the plant—such as the roots, bark, seeds, and flowers—is known for its healing potential. Abundant in flavonoids and antioxidants, *Oroxylum*

indicum possesses antimicrobial, anti-inflammatory, and antidiarrheal properties, making it an effective natural treatment for digestive and inflammatory ailments (2,10).

b) **Microcrystalline Cellulose (MCC)** – Diluent and Binder
• Purpose: Serves as a diluent to add bulk and as a binder to promote tablet cohesion.
• Grade Selected: Avicel PH 102 (commonly used for direct compression).
• Characteristics:

- Superior compressibility
- Improves tablet hardness while maintaining disintegration
- Exhibits good flow properties

c) **Croscarmellose Sodium –**

Superdisintegrant
• Role: Facilitates quick tablet breakdown when exposed to gastrointestinal fluids.
•Typical Amount: Usually used at 2–5% w/w
• Features:

- Rapid swelling capacity
- Promotes faster release of the active ingredients

d) **Magnesium Stearate –**

Lubricant
• Purpose: Prevents the tablet mixture from sticking to the punches and dies during compression.
•Usage Level: Typically 0.5–1% w/w
• Characteristics:

- Hydrophobic, so it should be used sparingly to avoid hindering disintegration
- Decreases friction and facilitates tablet ejection

e) **Colloidal Silicon Dioxide –**

Glidant
• Role: Improves the flowability of the powder mixture by minimizing friction between particles.
•Typical Concentration: 0.1–0.5% w/w
• Features:

- Facilitates consistent die filling
- Highly porous and moisture-absorbing, which enhances the stability of the blend

f) **Polyvinylpyrrolidone (PVP K30) –** Binder (optional)
• Purpose: Can be added in small quantities to enhance binding, especially when tablets show poor cohesion.
• Application: Used either as a dry powder or dissolved in solution for wet granulation, though it is typically optional for direct compression.

3. MATERIAL & METHOD

The selection of material in the preparation of tablet is almost used herbal constituent. The material used in the aromatic herbal agents for their flavor & stability.

Ingredients	Function	(F1)	(F2)	(F3)	(F4)
Oroxylum indicum extract	API	100 mg	100 mg	100 mg	100 mg
Microcrystalline cellulose	Diluent, Binder	250 mg	200 mg	220 mg	240 mg
Croscarmellose sodium	Superdisintegrant	50 mg	52 mg	50 mg	55 mg
Magnesium stearate	Lubricant	30 mg	20 mg	25 mg	35 mg
Colloidal silicon dioxide	Glidant	10 mg	15 mg	20 mg	5 mg
Mannitol (optional)	Sweetener, Diluent	20 mg	15 mg	10 mg	25 mg
Talc (optional)	Glidant/Lubricant	15 mg	10 mg	20 mg	25 mg
PVP K30 (optional)	Binder	20 mg	10 mg	15 mg	25 mg

Table no.1 Material used in the formulation

❖ **Procedure for Making Herbal Tablet- (Methodology)**

- Select all Herbal (Aromatic) Ingredients
- All components should be dried and ground into a powder.

Fig no.2 weighing all the Ingredients

- The excipients and herbal powder are combined.
- To make a paste, combine powdered herbal components and excipients that with an adhesion solution (such as Ethanol).

Fig no.3 Preparation of Dough Mass

- To create granules, run the mixture through a sieve, use an oven to dry the grains.

Fig no.4 Screening the Product to make Granules

- After that, an edible tablet press equipment receives the granules and compresses them into chewable tablets.
- To create tablets with a specific size and shape, compression is applied by the tablet printing machine.

Fig no.5 Punching the Tablets

- The tablet is chewable form (oval in shape) that is easy to chew & swallow.

4. Evaluation

Organoleptic Testing	Analysis Test
☐ Shape	☐ Hardness Test
☐ Flavour	☐ Friability
☐ Colour	☐ pH
☐ Odor	☐ Disintegration Time

- **Weight Uniformity Test -** Assures that the proper proportion of excipients and active components are present in every pill.
- **Hardness Test -** Verify that the tablet is both excessively soft (which might cause it to crumble) nor too firm (which could make it harder to chew) by measuring the force needed for it to fracture or crush it (12).

- **Friability Test -** Examines the tablet's resistance to breaking or chipping under physical handling and mechanical force.
- **Disintegration Test -** To make sure that the active components are efficiently released when the tablets are chewed and dissolve in the mouth.
- **Stability Testing -** To determine the tablets' resistance to various environmental factors (such as sunlight and moistness, and warmth).
- **Organoleptic Testing -** Ensure that the chewable tablet has a flavor, look, and smell that the patient will find appropriate, which is essential for customer satisfaction.
- **pH Test -** Verifies that the tablet's pH level is within the ideal range for maximum absorption when it disintegrates in saliva or a manufactured saliva solution.
- **Moisture Content Test -** Need to make sure there isn't too much moisture in the pill, since this might cause the active components to degrade and compromise stability.
- **Shelf-life Evaluation -** Assures that the tablets' purity and efficacy are maintained throughout time (11).

5. Result

a) Organoleptic Testing –

The appearance of chewable tablet is simple and it is easier to consumer acceptances.

S.no	Parameter	Result
01	Colour	Brown
02	Flavour	Slightly Sweet
03	Shape	Oval
04	Consistency	Solid
05	Odor	Characteristic

Fig no.6 Physical appearance

b) Analysis Testing of Chewable Tablet

- **Hardness Test –**

S.no	Sample	Hardness (kg)
1	1	5.2
2	2	6.0
3	3	4.8
4	4	5.5

Fig no.7 Performing Hardness Test

- **Friability-**

Sample	Intial Weight	Final Weight	Friability (%)
1	5.1 gm	4.95 gm	1.95
2	5.3 gm	5.1 gm	1.60
3	5.1 gm	5.0 gm	0.90
4	5.2 gm	4.98 gm	2.1

Fig no.8 Performing Friability Test

c) Result of analysis testing of chewable tablet

S.no	Test	Result
01	Hardness Test	5.37 kg
02	Friability	1.6%
03	Disintegration Time	15-20 min
04	Weight Variation Test	±5%
04	pH	6.5 to 7.5

6. DISCUSSION

The development of herbal tablets containing *Oroxylum indicum* extract offers a solution that is both scientifically validated and grounded in traditional medicine for the treatment of diarrhea and dysentery. Commonly referred to as the Indian trumpet tree, *Oroxylum indicum* has a well-established history in Ayurveda, particularly for its positive impact on digestive health (13). The plant's bark, leaves, and seeds contain numerous bioactive compounds—including flavonoids

like baicalein and chrysin, as well as tannins and alkaloids—that are responsible for its anti-inflammatory, antimicrobial, antispasmodic, and antidiarrheal effects (15).

Modern pharmacological research corroborates these traditional uses, showing that the extract can help alleviate intestinal inflammation, suppress the growth of pathogenic microbes, and regulate bowel movements. These actions are essential for not only relieving the symptoms of diarrhea and dysentery but also addressing their root causes (16).

7. CONCLUSION

Herbal tablets containing *Oroxylum indicum* extract offer a comprehensive and promising solution for treating diarrhea and dysentery (14,17). Rooted in traditional Ayurvedic practices and supported by modern scientific findings, *Oroxylum indicum* exhibits a blend of therapeutic actions—including anti-inflammatory, antimicrobial, antispasmodic, and antidiarrheal effects—that address both symptoms and root causes of gastrointestinal issues (18). The use of appropriate pharmaceutical excipients enhances the formulation's stability, effectiveness, and ease of administration. Although preclinical studies have shown encouraging results, additional clinical trials are necessary to establish its safety, efficacy, and optimal dosage in humans. Ultimately, these herbal tablets serve as a natural and effective alternative or complementary treatment for common digestive disorders (19,20).

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