

FORMULATION AND PHYSICOCHEMICAL EVALUATION OF A POLYHERBAL
ANTACID POWDER CONTAINING SELECTED MEDICINAL PLANTSP. Hemanth Kumar¹, P. Jahnvi¹, B. Poojitha¹, P. Srinivasa Babu², A. Bhavani Sailu^{1*}¹Department of Pharmaceutical Analysis, Vignan Pharmacy College, Vadlamudi, Guntur, 522213, Andhra Pradesh, India.²Department of Pharmaceutics, Vignan Pharmacy College, Vadlamudi, Guntur, 522213, Andhra Pradesh, India.***Corresponding Author: A. Bhavani Sailu**Department of Pharmaceutical Analysis, Vignan Pharmacy College, Vadlamudi, Guntur, 522213, Andhra Pradesh, India. DOI: <https://doi.org/10.5281/zenodo.23275349>**How to cite this Article:** P. Hemanth Kumar¹, P. Jahnvi¹, B. Poojitha¹, P. Srinivasa Babu², A. Bhavani Sailu^{1*} (2026). Formulation And Physicochemical Evaluation Of A Polyherbal Antacid Powder Containing Selected Medicinal Plants. European Journal of Pharmaceutical and Medical Research, 13(10), 430-436.

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ABSTRACT

Herbal medicines are increasingly explored as safer alternatives to conventional antacids because of their therapeutic efficacy, natural origin, and lower incidence of adverse effects. The present mini project aimed to formulate and evaluate a herbal antacid powder using namely **Dried Ginger (*Zingiber officinale*)**, **Fennel (*Foeniculum vulgare*)**, **Liquorice (*Glycyrrhiza glabra*)**, **Coriander (*Coriandrum sativum*)**, **Amla (*Phyllanthus emblica*)**, and **Cardamom (*Elettaria cardamomum*)**. These herbs were selected based on their well-established digestive, carminative, anti-ulcer, antioxidant, and gastroprotective properties. The formulation was prepared by drying, pulverizing, sieving, accurately weighing, and uniformly blending the powdered ingredients before packaging in airtight containers. The prepared formulation was evaluated for organoleptic characteristics, particle size distribution, bulk density, tapped density, angle of repose, pH, moisture content, acid-neutralizing capacity, and stability under both room temperature and accelerated storage conditions. The formulation exhibited acceptable physicochemical characteristics, good flow properties, desirable pH, low moisture content, and satisfactory acid-neutralizing capacity, indicating its effectiveness in neutralizing gastric acid. Stability studies demonstrated that the formulation retained its quality and performance throughout the storage period. The results suggest that the developed herbal antacid powder is a stable, economical, and promising natural formulation for the symptomatic management of hyperacidity and related gastrointestinal disorders. Further pharmacological and clinical investigations are recommended to establish its efficacy, safety, and long-term therapeutic potential.

KEYWORDS: Herbal antacid powder, Acid-neutralizing capacity, Medicinal plants, Physicochemical evaluation, Gastroprotective activity.**1. INTRODUCTION**

Herbal medicines have been used for thousands of years as an integral part of traditional healthcare systems such as Ayurveda, Siddha, Unani, Traditional Chinese Medicine (TCM), and various indigenous systems across the world. According to the World Health Organization (WHO), nearly 80% of the population in developing countries relies on herbal medicines for primary healthcare because of their accessibility, affordability, and perceived safety. Herbal formulations contain biologically active phytochemicals such as alkaloids, flavonoids, phenolic compounds, tannins, terpenoids, glycosides, saponins, and essential oils, which contribute

to their diverse pharmacological activities including antioxidant, anti-inflammatory, antimicrobial, gastroprotective, and digestive effects. Compared to synthetic drugs, herbal medicines are generally associated with fewer adverse effects and have gained considerable attention in modern pharmaceutical research as complementary or alternative therapeutic agents.^[1-10]

Gastrointestinal disorders such as hyperacidity, acid reflux, dyspepsia, gastritis, and peptic ulcer disease are among the most common health problems worldwide. Hyperacidity results from excessive secretion of

hydrochloric acid (HCl) by the gastric parietal cells or from an imbalance between aggressive factors (acid, pepsin, bile salts) and protective mechanisms (mucus, bicarbonate, prostaglandins, and mucosal blood flow). Common symptoms include heartburn, epigastric pain, indigestion, bloating, nausea, and regurgitation, which significantly affect the quality of life. Lifestyle changes, consumption of spicy foods, alcohol, smoking, stress, prolonged use of non-steroidal anti-inflammatory drugs (NSAIDs), and *Helicobacter pylori* infection are major contributing factors to acid-related disorders.

Antacids are substances that neutralize gastric hydrochloric acid and provide rapid symptomatic relief from hyperacidity and heartburn. Conventional antacids mainly consist of alkaline compounds such as magnesium hydroxide, aluminum hydroxide, calcium carbonate, and sodium bicarbonate. These agents increase gastric pH, reduce pepsin activity, and alleviate acid-induced irritation of the gastric mucosa. Although synthetic antacids are effective, their long-term or excessive use may lead to adverse effects including constipation, diarrhea, electrolyte imbalance, rebound acidity, milk-alkali syndrome, and interactions with several orally administered drugs. Consequently, there is increasing interest in developing herbal antacid formulations that are safer, economical, and possess

additional therapeutic benefits such as antioxidant, anti-inflammatory, carminative, gastroprotective, and digestive properties.

Herbal antacid formulations combine medicinal plants known for their ability to protect the gastric mucosa, improve digestion, reduce flatulence, and alleviate gastrointestinal discomfort. The present study focuses on the formulation of a herbal antacid powder using selected medicinal plants, namely **dried ginger (*Zingiber officinale*)**, **fennel (*Foeniculum vulgare*)**, **liquorice (*Glycyrrhiza glabra*)**, **coriander (*Coriandrum sativum*)**, **amla (*Phyllanthus emblica*)**, and **cardamom (*Elettaria cardamomum*)**, each of which possesses well-documented digestive and gastroprotective properties. Ginger contains gingerols and shogaols that exhibit anti-inflammatory, antioxidant, and digestive activities. Fennel is rich in anethole and fenchone, which act as carminative agents and relieve gastrointestinal spasms. Liquorice contains glycyrrhizin and flavonoids that protect the gastric mucosa and promote ulcer healing. Coriander contains linalool and other essential oils that improve digestion and reduce flatulence. Amla is an excellent source of vitamin C and polyphenols with potent antioxidant activity, while cardamom contains cineole and terpinyl acetate, which enhance digestion and provide a pleasant aroma to the formulation.^[11-15]

Table-1: Pharmacognostic Profile of Selected Crude Drugs.^[16-22]

Crude Drug (Botanical Name)	Biological Source / Family	Major Chemical Constituents	Marker Compounds (Chemical Structures to Study)	Major Uses
Dried Ginger (<i>Zingiber officinale</i>)	Dried rhizomes; Zingiberaceae	Gingerols (6-, 8-, 10-gingerol), Shogaols, Zingerone, Volatile oil (Zingiberene, β -Sesquiphellandrene, Bisabolene, Cineole, Citral), Starch	6-Gingerol, 6-Shogaol, Zingiberene	Carminative, Antiemetic, Anti-inflammatory, Digestive stimulant, Antioxidant
Fennel (<i>Foeniculum vulgare</i>)	Dried ripe fruits; Apiaceae	Volatile oil (trans-Anethole, Fenchone, Estragole, Limonene, α -Pinene), Fixed oil, Flavonoids	trans-Anethole, Fenchone, Estragole	Carminative, Digestive, Expectorant, Galactagogue, Antimicrobial
Liquorice (<i>Glycyrrhiza glabra</i>)	Dried roots & stolons; Fabaceae	Glycyrrhizin, Glycyrrhetic acid, Liquiritin, Isoliquiritin, Glabridin, Sugars, Starch	Glycyrrhizin, Glycyrrhetic acid, Liquiritin	Expectorant, Anti-inflammatory, Anti-ulcer, Hepatoprotective, Sweetening agent
Coriander (<i>Coriandrum sativum</i>)	Dried ripe fruits; Apiaceae	Volatile oil (Linalool, Geraniol, Borneol, Camphor, α -Pinene), Fixed oil, Flavonoids	Linalool, Geraniol, Borneol	Carminative, Digestive, Antioxidant, Antimicrobial, Appetite stimulant
Amla (<i>Phyllanthus emblica</i>)	Fresh or dried fruits; Phyllanthaceae	Ascorbic acid, Emblicanin A & B, Gallic acid, Ellagic acid, Punigluconin, Pedunculagin, Flavonoids	Ascorbic acid, Gallic acid, Ellagic acid	Antioxidant, Immunomodulator, Hepatoprotective, Antidiabetic, Hair tonic
Cardamom (<i>Elettaria cardamomum</i>)	Dried ripe fruits (capsules); Zingiberaceae	Volatile oil (α -Terpinyl acetate, 1,8-Cineole, Limonene, Sabinene, Linalool), Fixed oil, Starch	α -Terpinyl acetate, 1,8-Cineole, Limonene	Carminative, Digestive, Expectorant, Mouth freshener, Antimicrobial

2. MATERIALS AND METHODOLOGY

2.1 Materials

2.1.1 Herbal Ingredients

The herbal antacid powder was prepared using six medicinal plants selected based on their reported digestive, gastroprotective, antioxidant, anti-

inflammatory, and carminative properties. All crude drugs were procured from a reliable herbal supplier and authenticated using standard Pharmacognostic characteristics before use. The composition of the formulation is shown in Table 3.1.

Table-2: Composition of Herbal Antacid Powder.

S.No	Ingredient	Botanical Name	Quantity (% w/w)	Therapeutic Role
1	Dried Ginger Powder	<i>Zingiber officinale</i>	20	Digestive stimulant, anti-inflammatory
2	Fennel Powder	<i>Foeniculum vulgare</i>	25	Carminative
3	Liquorice Powder	<i>Glycyrrhiza glabra</i>	20	Gastroprotective, anti-ulcer
4	Coriander Powder	<i>Coriandrum sativum</i>	20	Digestive, cooling agent
5	Amla Powder	<i>Phyllanthus emblica</i>	10	Antioxidant
6	Cardamom Powder	<i>Elettaria cardamomum</i>	5	Flavoring agent

2.1.2 Chemicals

Table-3: List of analytical-grade chemicals used during evaluation.

Chemical	Purpose
Hydrochloric Acid (0.1 N)	Acid Neutralization Study
Sodium Hydroxide (0.1 N)	Back titration
Phenolphthalein Indicator	Indicator
Distilled Water	Preparation of solutions

3.1.3 Instruments

Table-4: List of Instruments and glassware used during evaluation.

Instrument	Purpose
Electronic Balance	Accurate weighing
Mechanical Grinder	Pulverization
Sieve No.80	Uniform particle size
Mortar and Pestle	Mixing
Graduated Cylinder	Density measurements
Digital pH Meter	pH determination
Hot Air Oven	Moisture content
Burette and Pipette	Titration
Conical Flask	ANC determination

moisture. Direct sunlight was avoided to prevent degradation of volatile oils and heat-sensitive phytoconstituents.

2.2.3 Pulverization

After drying, each herbal material was pulverized separately using a mechanical grinder to obtain fine powder. Care was taken to prevent overheating during grinding so that volatile constituents were not lost.

2.2.4 Sieving

The powdered materials were passed through a standard Sieve No. 80 to obtain a uniform particle size. Oversized particles retained on the sieve were reground and sieved again. Uniform particle size ensured better mixing, improved flow properties, and enhanced consistency of the formulation.

2.2.5 Weighing of Ingredients

Each powdered ingredient was accurately weighed using a calibrated electronic analytical balance according to the formulation shown in Table 3.1. Individual powders were weighed separately to minimize weighing errors and to ensure batch uniformity.

2.2.6 Preparation of Herbal Antacid Powder

The weighed powders were mixed by geometric dilution using a clean mortar and pestle. Mixing was continued for approximately 15–20 minutes until a homogeneous blend was obtained. The prepared herbal antacid powder was transferred into airtight laminated pouches or amber-colored containers, properly labelled, and stored in a cool, dry place away from direct sunlight until further evaluation.

2.2 METHODOLOGY

2.2.1 Procurement and Authentication of Plant Materials

The selected medicinal plants, namely dried ginger, fennel, liquorice, coriander, amla, and cardamom, were procured from an authenticated herbal drug supplier. The crude drugs were carefully examined for their macroscopic and organoleptic characteristics and authenticated using standard Pharmacognostic parameters. Foreign matter such as dust, stones, and other extraneous materials was removed manually before further processing.

2.2.2 Drying of Plant Materials

The authenticated crude drugs were spread uniformly on clean trays and shade dried at room temperature (25–30°C) for 5–7 days. The materials were turned periodically to ensure uniform drying and to prevent fungal growth. Drying was continued until constant weight was achieved, indicating complete removal of

2.3 Evaluation of Herbal Antacid Powder

2.3.1 Organoleptic Evaluation

The prepared formulation was visually inspected for colour, odour, taste, texture, and overall appearance. Observations were recorded to ensure batch consistency.

Table-5: Observations of Organoleptic Evaluation.

Parameter	Observation
Colour	Light brown to brown
Odour	Aromatic
Taste	Slightly sweet and spicy
Appearance	Fine powder

2.3.2 Particle Size Analysis

Approximately 10 g of the herbal powder was placed on the top sieve of a stack of standard sieves arranged in descending mesh size. The sieves were shaken mechanically for 10 minutes. The powder retained on each sieve was weighed, and the percentage retained was calculated to determine the particle size distribution.

Formula

$$\% \text{ Retained} = \frac{\text{Weight retained}}{\text{Total Weight}} * 100$$

2.3.3 Determination of Bulk Density

10 grams of the prepared powder was carefully introduced into a clean, dry graduated cylinder without compacting the material. The initial volume occupied by the powder was noted. Bulk density was calculated using the equation:

$$\text{Bulk Density} = \frac{\text{Mass of Powder}}{\text{Bulk Volume}}$$

2.3.4 Determination of Tapped Density

The same graduated cylinder containing the powder was tapped mechanically 100 times until no further change in volume was observed. The final volume was recorded, and tapped density was calculated using the following equation

$$\text{Tapped Density} = \frac{\text{Mass of Powder}}{\text{Tapped Volume}}$$

2.3.5 Determination of Angle of Repose

The fixed funnel method was employed. The herbal powder was allowed to flow freely through a funnel placed at a fixed height above a horizontal surface. The height (h) and radius (r) of the resulting powder cone were measured, and the angle of repose was calculated using

$$\theta = \tan^{-1} \left(\frac{h}{r} \right)$$

RESULTS AND DISCUSSION**3.1 Organoleptic Evaluation****Table-6: Results of physical characteristics.**

Parameter	Observation	Standard Requirement	Result
Colour	Light Brown	Light brown to brown	Pass
Odour	Pleasant Aromatic	Aromatic	Pass
Taste	Slightly Sweet and Spicy	Characteristic	Pass
Appearance	Fine Uniform Powder	Free flowing powder	Pass

2.3.6 Determination of pH

One gram of the herbal antacid powder was dispersed in 100 mL of distilled water and stirred continuously for 30 minutes. The suspension was filtered, and the pH of the filtrate was measured using a calibrated digital pH meter. Measurements were performed in triplicate, and the average value was recorded.

2.3.7 Determination of Moisture Content (Loss on Drying)

Approximately 2 g of the formulation was accurately weighed in a previously dried and weighed moisture dish. The sample was dried in a hot air oven maintained at 105°C until constant weight was obtained. After cooling in a desiccator, the final weight was recorded, and the percentage loss on drying was calculated.

$$\% \text{ LOD} = \frac{\text{Initial} - \text{Final}}{\text{Initial}} * 100$$

2.3.8 Determination of Acid Neutralizing Capacity (ANC)

1 gram of the herbal antacid powder was accurately weighed into a conical flask, and 50 mL of 0.1 N hydrochloric acid was added. The mixture was stirred continuously for 15 minutes to allow complete neutralization. The contents were then filtered, and the excess hydrochloric acid present in the filtrate was back-titrated against standardized 0.1 N sodium hydroxide using phenolphthalein as the indicator until a permanent pale pink endpoint was obtained. The acid-neutralizing capacity was calculated using the following equation.

$$\text{ANC} = (V_{\text{HCl}} \times N_{\text{HCl}}) - (V_{\text{NaOH}} \times N_{\text{NaOH}})$$

where:

- (V_{HCl}) = Volume of HCl added (mL)
- (N_{HCl}) = Normality of HCl
- (V_{NaOH}) = Volume of NaOH consumed (mL)
- (N_{NaOH}) = Normality of NaOH

2.3.9 Stability Studies

The prepared herbal antacid powder was packed in airtight containers and stored under two different conditions: room temperature ($25 \pm 2^\circ\text{C}$) and accelerated conditions ($40 \pm 2^\circ\text{C}$ with 75% relative humidity). Samples were withdrawn initially and after 1, 2, and 3 months for evaluation of colour, odour, pH, moisture content, and acid-neutralizing capacity to assess the physical and chemical stability of the formulation.

DISCUSSION

The powder exhibited good organoleptic characteristics indicating proper selection and processing of herbal

ingredients. The pleasant aroma and acceptable taste improve patient compliance.

3.2 Particle Size Distribution**Table-7: Observations of Particle Size Distribution.**

Sieve No.	Particle Size (µm)	Weight Retained (g)	% Retained
20	850	0.15	1.5
40	425	0.65	6.5
60	250	2.30	23.0
80	180	5.40	54.0
Pan	<180	1.50	15.0

Total Weight = 10 g

RESULT

More than **50%** of the formulation passed through Sieve No.80 indicating a fine powder suitable for uniform mixing and better dissolution.

3.3 Bulk Density**Observation**

Mass of powder = **10 g**

Initial Volume = **17.8 mL**

RESULT

Parameter	Value
Bulk Density	0.562 g/mL

3.4 Tapped Density

After tapping 100 times

Final Volume = **15.2 mL**

RESULT

Parameter	Value
Tapped Density	0.658 g/mL

3.5 Compressibility Index (Carr's Index)**Result**

Parameter	Value
Carr's Index	14.59%

Interpretation

10–15% indicates **Good Flowability**

3.6 Hausner Ratio**Result**

Parameter	Value
Hausner Ratio	1.17

Interpretation

Hausner Ratio less than **1.25** indicates good flow properties.

3.7 Angle of Repose

Observed

Height (h)=4.3 cm

Result

Parameter	Value
Angle of Repose	27.7°

Interpretation

Less than **30°** indicates excellent powder flow.

3.8 pH Determination

Trial	pH
1	7.21
2	7.32
3	7.28

Average pH

$$\text{Average} = \frac{7.21 + 7.32 + 7.28}{3} = 7.27$$

Result

Average pH = **7.27**

The formulation showed nearly neutral pH suitable for antacid preparations.

3.9 Moisture Content (Loss on Drying)

Initial Weight = **2.000 g**

Final Weight = **1.930 g**

Result

Parameter	Value
Moisture Content	3.50%

Interpretation

Less than **5%** moisture indicates good storage stability.

3.10 Acid Neutralizing Capacity (ANC)

Volume of HCl added = **50 mL**

Normality of HCl = **0.1 N**

Volume of NaOH used = **12.8 mL**

Normality of NaOH = **0.1 N**

Result

Parameter	Value
Acid Neutralizing Capacity	3.72 mEq/g

3.11 Stability Study

Table-8: Observations of Stability study.

Parameter	Initial	1 Month	2 Months	3 Months
Colour	Light Brown	No Change	No Change	No Change
Odour	Aromatic	No Change	No Change	Slight Change
pH	7.27	7.25	7.24	7.20
Moisture (%)	3.50	3.58	3.62	3.69
ANC (mEq/g)	3.72	3.69	3.67	3.63

Interpretation

No significant variation was observed during three months of storage, indicating good stability of the formulation under recommended storage conditions.

Table-9: Summary of Evaluation Results.

Test	Result	Standard	Status
Colour	Light Brown	Acceptable	Pass
Odour	Aromatic	Acceptable	Pass
Taste	Sweet-Spicy	Acceptable	Pass
Bulk Density	0.562 g/mL	0.4–0.8	Pass
Tapped Density	0.658 g/mL	>Bulk Density	Pass
Carr's Index	14.59%	<15%	Pass
Hausner Ratio	1.17	<1.25	Pass
Angle of Repose	27.7°	<30°	Pass
pH	7.27	6.5–8.5	Pass
Moisture Content	3.50%	<5%	Pass
ANC	3.72 mEq/g	Satisfactory	Pass
Stability	Stable	No major changes	Pass

CONCLUSION

The present study successfully formulated and evaluated a polyherbal antacid powder containing dried ginger, fennel, liquorice, coriander, amla, and cardamom. The formulation exhibited satisfactory organoleptic characteristics, excellent flow properties, acceptable physicochemical parameters, nearly neutral pH, low moisture content, and good acid-neutralizing capacity, indicating its suitability as an effective herbal antacid. Stability studies further demonstrated that the formulation maintained its quality and performance under both room-temperature and accelerated storage conditions with no significant changes. The synergistic action of the selected medicinal plants offers additional gastroprotective, digestive, antioxidant, and anti-inflammatory benefits, making the formulation a promising natural alternative to conventional antacids. Overall, the developed polyherbal antacid powder is stable, economical, and suitable for the symptomatic management of hyperacidity and related gastrointestinal disorders. However, further pharmacological, toxicological, and clinical studies are warranted to confirm its long-term safety, efficacy, and therapeutic potential.

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CONFLICT OF INTERESTS

Authors declare that there is no conflict of interest.

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