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A Review on Herbal Active Constituents and Their Formulation Approaches for the Management of Gastric Ulcer

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ABSTRACT
The present study focuses on the preparation, characterization, and development of a herbal tablet formulation containing active phytoconstituents for the effective management of gastric ulcers. Herbal medicines have gained increasing attention due to their efficacy, safety profile, and minimal side effects compared to synthetic drugs. In this research, selected herbal extracts possessing proven anti-ulcer properties were formulated into tablets using suitable excipients and evaluated for various pre- and post-compression parameters such as hardness, friability, disintegration time, and drug content uniformity. Phytochemical screening and characterization of the active constituents were performed using standard analytical techniques to ensure quality and consistency. The in-vitro anti-ulcer activity was assessed using simulated gastric fluid models, demonstrating significant protective effects against ulcer formation. The results confirmed that the developed herbal tablet formulation exhibited desirable physicochemical properties, stability, and promising therapeutic potential for gastric ulcer management. This study highlights the potential of standardized herbal formulations as effective and safer alternatives to conventional anti-ulcer therapies.

Keywords: Herbal formulation, Gastric ulcer, Phytoconstituents, Tablet development, Characterization, Anti-ulcer activity, Phytochemical analysis, Natural therapeutics

I. INTRODUCTION

Gastric ulcer, a common form of peptic ulcer disease, is characterized by the formation of sores or lesions on the lining of the stomach due to an imbalance between aggressive factors such as gastric acid, pepsin secretion, and defensive factors like mucus and bicarbonate secretion. This condition affects millions of people worldwide and poses a significant public health concern due to its chronic nature and potential complications, including bleeding, perforation, and gastric cancer**(Jaiswal et al., 2021).**

The major causes of gastric ulcers include infection by Helicobacter pylori, prolonged use of nonsteroidal anti-inflammatory drugs (NSAIDs), excessive alcohol consumption, smoking, stress, and poor dietary habits. Conventional treatments primarily involve the use of proton pump inhibitors (PPIs), H_2 receptor antagonists, and antibiotics. However, these synthetic drugs are often associated with side effects and relapse upon discontinuation**(Khan et al., 2023).**

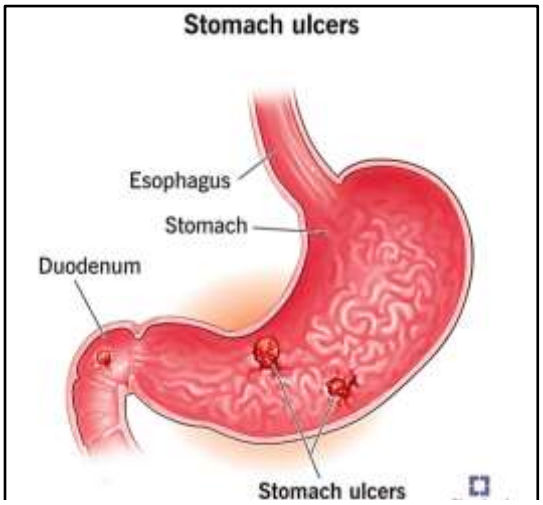

Figure 1. Gastric ulcer

In recent years, there has been a growing interest in the development of herbal and natural remedies for gastric ulcer management. Medicinal plants contain bioactive phytoconstituents such as flavonoids, tannins, alkaloids, and saponins, which possess antioxidant, anti-inflammatory, and cytoprotective properties. These compounds not only aid in healing the gastric mucosa but also help in restoring the balance between protective and aggressive gastric factors. Hence, exploring herbal-based formulations offers a promising and safer alternative approach for the prevention and

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treatment of gastric ulcers**(Yandrapu and Sarosiek 2015).**

II. PHYTOCHEMICALS AND MECHANISMS RELEVANT TO ANTI-ULCER ACTIVITY

Gastric ulcer healing and protection involve a complex interplay between oxidative stress, inflammation, gastric acid secretion, mucosal regeneration, and microbial infection (particularly Helicobacter pylori). Phytochemicals—bioactive compounds naturally present in medicinal plants—exert their anti-ulcer activity through multiple pharmacological mechanisms, including antioxidant, cytoprotective, antisecretory, and antimicrobial actions. The main classes of these compounds and their mechanistic roles are described below**(Sharifi-Rad et al., 2018).**

2.1 Flavonoids

Flavonoids are polyphenolic compounds widely distributed in plants, known for their potent antioxidant and free radical–scavenging activities. They neutralize reactive oxygen species (ROS) such as superoxide and hydroxyl radicals, which play a key role in damaging the gastric mucosa. By reducing oxidative stress, flavonoids protect gastric epithelial cells from lipid peroxidation and oxidative injury **(Kaurinovic and Vastag 2019).**
Examples: Quercetin, Rutin, Catechin, Naringenin, Kaempferol

Mechanisms of action:

- **Antioxidant and cytoprotective:** Flavonoids upregulate antioxidant enzymes like superoxide dismutase (SOD), catalase (CAT), and glutathione peroxidase (GPx), enhancing mucosal defense.
- **Prostaglandin stimulation:** They stimulate endogenous prostaglandin synthesis, which increases mucus and bicarbonate secretion, thereby strengthening the mucosal barrier.
- **Anti-secretory effect:** Some flavonoids inhibit histamine-induced gastric acid secretion by blocking H^+/K^+-ATPase activity**(Miyazaki et al., 2018).**

2.2 Tannins

Tannins are high–molecular weight polyphenols known for their astringent properties and protein-precipitating capacity. These compounds form a protective complex with the surface proteins of the gastric mucosa, creating a physical barrier that prevents acid and pepsin penetration into the underlying tissues**(Soares et al., 2020).**
Examples: Ellagitannins, Gallotannins, Catechins, Proanthocyanidins

Mechanisms of action:

- **Formation of a protective coat:** Tannins interact with mucosal proteins to form an insoluble layer that shields epithelial cells from acid and enzymatic attack.
- **Astringent and anti-secretory effects:** They constrict blood vessels, reduce capillary permeability, and decrease secretion of gastric acid and pepsin.
- **Antioxidant activity:** Tannins neutralize free radicals and prevent oxidative stress–induced damage to the gastric mucosa**(Cheng et al., 2017).**

2.3 Saponins

Saponins are glycosidic compounds that exhibit both surface-active and biological properties. Their amphiphilic structure allows them to interact with lipid membranes, enhancing mucosal defense mechanisms**(Akbariet al., 2023).**
Examples: Diosgenin, Glycyrrhizin, Ginsenosides, Hederagenin

Mechanisms of action:

- **Stimulation of mucus secretion:** Saponins increase the production of gastric mucus, forming a thick protective layer over the mucosa that prevents acid diffusion.
- **Cytoprotective effect:** They promote the synthesis of prostaglandins (especially PGE_2), which enhances mucosal integrity and accelerates healing.
- **Anti-inflammatory activity:** Saponins inhibit the release of histamine and inflammatory cytokines from mast cells and macrophages **(Wijesekaraet al., 2024).**

2.4 Terpenoids and Essential Oils

Terpenoids (including mono-, di-, and triterpenes) and essential oils are volatile compounds with well-documented anti-inflammatory, antioxidant, and antisecretory effects **(Stephane, 2020).**
Examples: Limonene, Menthol, Carvacrol, Curcuminoids, Ursolic acid

Mechanisms of action:

- **Inhibition of gastric acid secretion:** Terpenoids suppress histamine- and gastrin-

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induced acid secretion by modulating H^+ /K^+ - ATPase activity.

- **Anti-inflammatory activity:** They inhibit key inflammatory mediators like COX-2, TNF-α, and IL-6, which are implicated in mucosal injury.
- **Antioxidant effects:** Essential oils rich in terpenes reduce oxidative damage by enhancing the activity of endogenous antioxidants **(Baccouri and Rajhi 2021).**

2.5 Alkaloids

Alkaloids are nitrogen-containing compounds with a wide range of biological effects. Their anti-ulcer activity depends on the specific molecular structure and mode of action **(Ibraheem, 2021).**

Examples: Berberine, Piperine, Solanine, Caffeine

Mechanisms of action:

- **Anti-secretory effects:** Certain alkaloids inhibit acid secretion by antagonizing muscarinic receptors or directly suppressing parietal cell activity.
- **Cytoprotective effects:** Alkaloids such as berberine promote mucus and bicarbonate secretion and improve mucosal resistance.
- **Anti-inflammatory and antimicrobial effects:** Berberine, in particular, exhibits strong anti-H. pylori activity and modulates inflammatory signaling pathways (e.g., NF-κB inhibition)**(Zhang e al., 2025).**

2.6 Polysaccharides (Mucilages)

Polysaccharides and mucilaginous substances are high–molecular weight carbohydrate polymers that exert physical and biological protection on gastric mucosa **(AlSaidyet al., 2021).**

Examples: Aloe vera gel, Plantagoovata husk, Marshmallow root extract

Mechanisms of action:

- **Formation of a protective barrier:** When hydrated, mucilages form a viscous gel that coats the stomach lining, shielding it from acid and pepsin.
- **Stimulation of epithelial regeneration:** Polysaccharides support mucosal cell proliferation and enhance angiogenesis in ulcerated areas.
- **Anti-inflammatory and antioxidant actions:** They reduce pro-inflammatory cytokine levels and protect against oxidative stress **(Zhang and Tsao 2016).**

2.7 Glycosides

Glycosides are compounds consisting of a sugar moiety linked to a non-sugar component (aglycone). Many exhibit potent anti-ulcer activity due to their anti-inflammatory and mucoprotective effects**(Khan et al., 2020).**

Examples: Glycyrrhizin (from Glycyrrhizaglabra), Salicin, Stevioside

Mechanisms of action:

- **Cytoprotective effects:** Glycyrrhizin enhances the secretion of mucus and bicarbonate while stabilizing gastric epithelial cells.
- **Anti-inflammatory activity:** It inhibits cyclooxygenase and lipoxygenase pathways, reducing prostaglandin and leukotriene synthesis associated with inflammation.
- **Antioxidant effects:** Glycosides reduce lipid peroxidation and enhance mucosal defense enzymes**(Illamet al., 2019).**

III. HERBAL TABLETS

Herbal Medicine is the oldest form of health care known to manhood. Herbs had been used by all cultures throughout history. It was an integral part of the development of modern civilization. Rude man observed and appreciated the great diversity of plants available to him. The plants provided food, clothing, shelter and medicine. Much of the medicinal use of plants seems to have been developed through observations of wild animals and by trial and error**(Süntar, 2020).**As time went on, each tribe added the medicinal power of herbs in their area to its knowledge base. They systematically collected information on herbs and developed well-defined herbal pharmacopoeias. Certainly, well into the 20th century much of the pharmacopoeia of scientific medicine was derived from the herbal tradition of natural people. Many drugs commonly used today are of herbal origin. Certainly, about 25 percent of the prescription drugs dispensed in the United States contain at least one active ingredient derived from plant material. Some are made from plant extracts; others are synthesized to copycat a natural plant compound. Herbal medicinal products are defined as any medicinal product, exclusively containing one or more active substances. WHO report 80% of the world population trusts on the drug from natural origin**(Gupta, 2015).**

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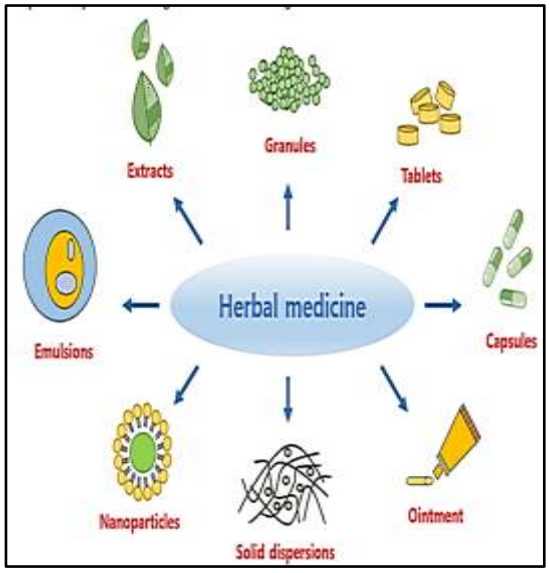

Figure 2. Herbal Medicine

Herbal tablets are solid dosage forms that contain one or more plant-derived ingredients, typically in the form of powdered herbs or concentrated herbal extracts, designed for oral consumption. These tablets are formulated to deliver specific therapeutic benefits through bioactive compounds found in the plant materials **(Dos Santos et al., 2025).** Herbal tablets are commonly used in traditional, complementary, and alternative medicine as a natural remedy for various health conditions. The active compounds in these tablets, such as alkaloids, flavonoids, terpenoids, and glycosides, are known for their antioxidant, anti-inflammatory, anti-microbial, and immune-modulating properties **(Riar and Panesar 2024).**

The process of making herbal tablets typically involves blending powdered herbal material or extracts with excipients such as binders, fillers, disintegrants, and lubricants. These excipients help to ensure the tablet maintains its shape, dissolves appropriately in the digestive system, and ensures consistency in dosing. The finished tablet form offers several advantages, including ease of storage, a longer shelf life compared to fresh or dried herbs, and a precise, consistent dose of the active herbal constituents **(Van der Merwe et al., 2020).**

IV. STANDARD PROCEDURE FOR THE PREPARATION OF HERBAL TABLETS

4.1 Selection and Sourcing of Raw Materials

- Herbal Material: The first step is to select high-quality herbal materials, such as powdered herbs, herbal extracts, or standardized herbal extracts. The herbal raw materials should be verified for quality, potency, and purity**(Nafiuet al., 2017).**
- Excipients: Select appropriate excipients such as binders, fillers, lubricants, disintegrants, and coatings. Common excipients include:
- Binders: Povidone, starch paste, hydroxypropyl methylcellulose (HPMC)
- Fillers: Microcrystalline cellulose (MCC), lactose, mannitol
- Disintegrants: Starch, croscarmellose sodium, sodium starch glycolate
- Lubricants: Magnesium stearate, stearic acid **(Ikasari, 2025).**

4.2 Preparation of Herbal Powder

- Grinding and Sieving: If the herb is in bulk form (whole or coarsely powdered), it must first be finely ground to an appropriate size (typically between 80-120 mesh). After grinding, the powder is sieved to remove larger particles and ensure uniformity.
- Blending with Excipient: The herbal powder is then blended with excipients such as fillers and disintegrants to create a homogeneous powder blend. This step is crucial to ensure even distribution of the active ingredient and excipients throughout the tablet **(Banerjee et al., 2025).**

4.3 Preparation of Herbal Extract

- Standardized Extraction: If using herbal extracts, ensure that the extract is standardized to a particular active compound (e.g., using HPLC or other methods). Extracts should be in a suitable form for tablet formulation (e.g., dry powder, concentrated liquid, or granulated).
- Mixing with Excipients: The herbal extract (in powder or paste form) is blended with excipients like fillers, binders, and disintegrants. If the extract is a liquid, a drying process (e.g., spray drying or freeze-drying) may be used to convert it into a powder for better handling**(Mam et al., 2023).**

4.4 Post-Compression Processing

- Coating (Optional): After compression, tablets can be coated to improve stability, taste, and appearance, or to control the release of active ingredients. Common types of coatings include:

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- Film Coating: Using polymers like HPMC, which forms a thin, protective film around the tablet**(Salawi, 2022).**
- Sugar Coating: A thicker coating that may improve the taste or appearance of the tablet.
- Enteric Coating: To protect the herbal tablet from stomach acid and release the active ingredient in the intestines**(Ghubeet al., 2020).**

4.5 Quality Control (QC)

Testing Once the tablets are prepared, they undergo rigorous quality control testing to ensure that they meet pharmacopoeial standards. Key tests include:

- Weight Variation Test: To ensure uniform weight distribution.
- Hardness Test: To ensure the tablet has sufficient mechanical strength.
- Disintegration Test: To ensure the tablet disintegrates properly in the gastrointestinal tract**(Silva et al., 2018).**
- Dissolution Test: To assess the release of active ingredients.
- Content Uniformity: To ensure that each tablet contains the correct amount of the active herbal ingredient.
- Microbial Testing: To ensure that the tablets are free from harmful microorganisms**(Santana et al., 2018).**

4.6 Packaging and Storage

- Packaging: Once the tablets pass all quality control tests, they are packaged in suitable containers (e.g., blister packs, bottles, or foil pouches) that protect them from moisture, light, and contamination.
- Storage: Tablets should be stored in a cool, dry place, away from direct sunlight, and in airtight containers to maintain their potency and stability**(Mohammed et al., 2023).**

V. METHOD OF PREPARATION

The preparation of herbal tablets involves several methods, each with its own procedures, advantages, and disadvantages. These methods are designed to ensure the stability, bioavailability, and efficacy of the herbal active ingredients, while also making the tablets easy to manufacture, store, and consume. Below is a detailed explanation of the primary methods of herbal tablet preparation, their procedures, advantages, and disadvantages, along with references to support the information **(Alamgir, 2017).**

5.1 Direct Compression Method

Procedure:

Direct compression is one of the simplest and most widely used methods for tablet formulation. It involves the direct compression of the powdered herb (or herbal extract) with excipients into tablets without requiring a liquid binder or a wet granulation process**(Dos Santoset al., 2025).**The steps include:

- Weighing the herbal powder and excipients.
- Blending the active ingredients (herbal powder) with excipients (such as fillers, lubricants, and disintegrants).
- Compressing the mixture into tablets using a tablet press.

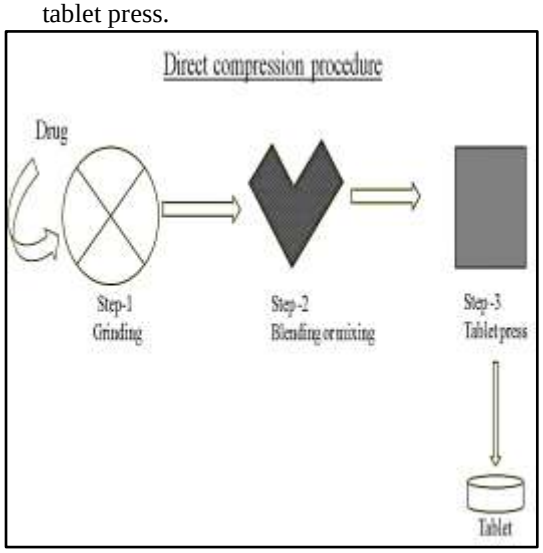

Figure 3. Direct Compression Method

Advantages:

- Simplified Process: This method does not require the use of heat or solvents, which makes it less timeconsuming and less prone to degradation of sensitive herbal compounds**(Rasul, 2018).**
- Cost-Effective: Since no wet granulation or drying is required, production costs are lower.
- Faster Production: The process is quicker compared to wet granulation, as fewer steps are involved.
- Minimal Processing: Reduces the exposure of active herbal ingredients to moisture or high temperatures, which could potentially degrade sensitive compounds**(Dhulipallaet al., 2023).**

Disadvantages:

- Flowability Issues: Some herbal powders have poor flow properties, making uniform mixing and compression difficult.

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- Poor Uniformity: Inconsistent distribution of the herbal ingredients in the final tablet, especially if the herbal powder is not homogeneous.
- Limited to Certain Herbs: This method is suitable only for herbal powders that have good compressibility and flow properties**(Ettiet al., 2016).**

5.2 Wet Granulation Method

Procedure:

Wet granulation involves the use of a liquid binder to form a granule mixture before compression. The general steps are:

- Weighing the herbal powder and excipients.
- Forming the Granules: The herbal powder is mixed with a binder solution (usually a water-based binder like povidone or starch paste)**(Boas, 2021).**
- Drying the Granules: The granules are dried to remove excess moisture.
- Sieving and Blending: The dried granules are sieved to ensure uniformity and then blended with excipients like lubricants**(Jakubowska and Ciepluch 2021).**
- Compression: The granules are compressed into tablets.

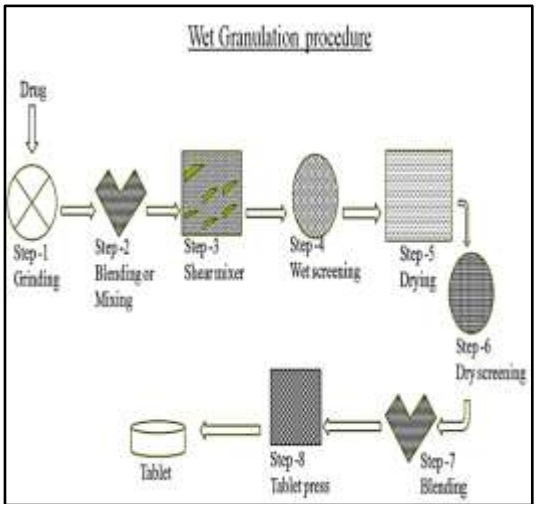

Figure 4. Wet Granulation Method

Advantages:

- Improved Flowability: Granulation improves the flow properties of the powder, making it easier to handle during the compression process**(Shah et al., 2023).**
- Uniformity of Content: The granulation process allows for a more uniform distribution of the active ingredients within the tablet.
- Increased Stability: Granulating the powder helps protect sensitive active ingredients from environmental factors like moisture and heat, improving the shelf life of the tablet**(Yee et al., 2024).**

Disadvantages:

- Time-Consuming: The process is more time-consuming compared to direct compression, as it involves multiple steps (mixing, wetting, drying, sieving) **(Rojas, 2015).**
- Potential Degradation of Active Ingredients: Some herbal compounds may degrade during the drying process due to exposure to heat or moisture.
- Higher Cost: The need for drying equipment, additional excipients (binders), and longer processing times increases manufacturing costs **(Binabet al., 2019).**

5.3 Dry Granulation Method (Slugging or Roller Compaction)

Procedure:

Dry granulation is used for materials that are sensitive to moisture or heat. The process involves:

- Weighing the herbal powder and excipients.
- Mixing the herbal powder with excipients like binders.
- Compression: The powder mixture is compressed into large tablets (slugs) using a tablet press or roller compactor.
- Sieving and Blending: The slugs are broken into smaller granules and sieved.
- Compression: The granules are compressed into final tablets **(De Villiers, 2021).**

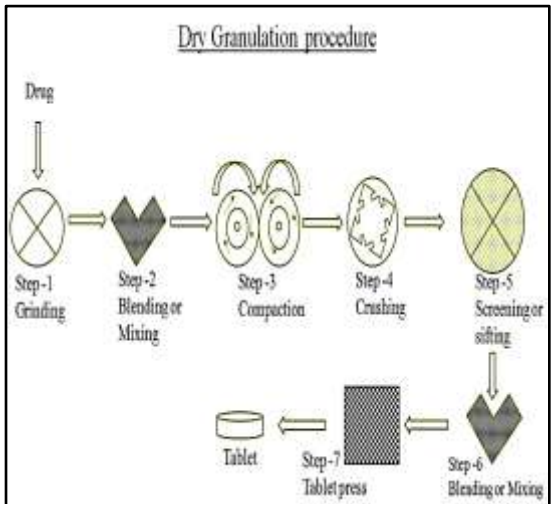

Figure 5. Dry Granulation Method

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Advantages:

- No Heat or Moisture Exposure: This method is ideal for heat- and moisture-sensitive herbs, as it does not require the use of solvents or drying.
- Improved Flowability: Similar to wet granulation, dry granulation helps to improve the powder's flow properties.
- Faster Process: Compared to wet granulation, dry granulation is faster as it eliminates the drying step**(Dhulipallaet al., 2023).**

Disadvantages:

- Equipment Intensive: Requires specialized equipment, such as a roller compactor or a tablet press, which increases initial investment costs.
- Potential for Uneven Granules: If not done carefully, the granules may not be uniform, leading to issues with tablet consistency.
- Not Suitable for All Herbs: Some herbal powders may not compress well, making the process unsuitable for certain plant materials**(Alamgir, 2017).**

5.4 Hot Melt Extrusion (HME)

Procedure:

Hot melt extrusion (HME) involves heating a mixture of herbal powders, excipients, and a polymer until it melts, after which it is forced through an extrusion die. The steps include:

- Weighing and Mixing: The herbal powder and excipients (including polymers) are mixed.
- Extrusion: The mixture is fed into an extruder, where it is melted and forced through a die.
- Cooling and Cutting: The extrudate is cooled, cut into small pieces, and then compressed into tablets**(Patil et al., 2016).**

Advantages:

- Controlled Release: HME allows for the creation of controlled-release herbal tablets by incorporating hydrophilic and hydrophobic polymers.
- Enhanced Stability: The extrusion process can protect active ingredients by encapsulating them in the polymer matrix, reducing degradation due to environmental factors.
- Good Uniformity: The mixing and extrusion process results in a homogeneous distribution of the herbal ingredients**(Alyamiet al., 2017).**

Disadvantages:

- High Equipment Cost: Extruders are expensive, and the process requires specialized equipment.
- Thermal Degradation: Some heat-sensitive herbal compounds may degrade during the extrusion process.
- Complex Process: The formulation and process require technical expertise and careful optimization**(ElGamalet al., 2023).**

5.5 Fluidized Bed Granulation

Procedure:

Fluidized bed granulation involves spraying a binder solution onto fluidized herbal powders in a chamber while they are agitated by an air stream. The general steps are:

- Weighing and preparing the herbal powder and excipients.
- Fluidization: The powder mixture is placed in a fluidized bed granulator where air is passed through it, causing the particles to float and move**(Parikh et al., 2016).**
- Spraying the Binder: A binder solution is sprayed onto the moving powder to form granules
- Drying: The granules are dried in the same chamber by blowing warm air through the mixture.
- Sieving and Compression: The granules are sieved, mixed with other excipients, and compressed into tablets**(Bhavana et al., 2023).**

Advantages:

- Homogeneous Granules: The fluidized bed technique produces uniform granules with good particle size distribution.
- Improved Dissolution Rate: Granules produced by this method tend to have higher surface areas, enhancing the dissolution and bioavailability of the herbal ingredients.
- High Quality Tablets: Fluidized bed granulation helps produce tablets with consistent quality, hardness, and uniformity**(Zhang et al., 2018).**

Disadvantages:

- Complex Equipment: Fluidized bed granulators are expensive and require specialized equipment.
- Time-Consuming: The process can be time-consuming due to the drying stage.

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- Potential for Overheating: The drying process may cause the degradation of heat-sensitive herbal components**(ElGamalet al., 2023).**

VI. EVALUATION OF TABLET

6.1. Pre-formulation study

6.1.1. Bulk density:

Bulk density was carried out in 100ml dried measuring cylinder. Pouring of dried granules in measuring cylinder and calculated by using the following formula**(Zhao et al., 2021).**

Bulk density = Mass of the granules/Bulk volume of the granules

6.1.2. Tapped density:

Tapped density was carried out by pouring of dried granules in 100ml measuring cylinder.100 tapping was done, note down the volume and calculate by using the following formula**(Azar, 2016).**

Tapped density = Granules weight/Volume of tapped granules

6.1.3. Hausner's ratio:

Hausner's ratio is the ratio of the tapped density of granules to the bulk density of granules. Calculated by using the following formula **(Akseliet al., 2019).**

Hausner's ratio= Tapped density/Bulk density

6.1.4. Carr's index

Carr's index or compressibility index is determined by the following formula.

$$\text{Carr's index} = \frac{\text{(Tapped density – Bulk density)}}{\text{Tapped density}}$$

6.1.5. Angle of repose:

Angle of repose was determined by using the funnel method.Following formula was used to calculate the angle of repose.

$\Theta = \text{Tan}^{-1}[h/r]$

Where h = height of granule cone formed.

r = radius of the granule cone formed.

6.2. Physical evaluation of tablets:

The tablets were subjected to the following evaluation tests.

6.2.1 General appearance:

The general appearance and colour of tablets were found by visual determination**(Barimani and Kleinebudde 2018).**

6.2.2 Hardness and thickness test:

The hardness and thickness of 20 tablets were determined. Hardness test was determined by Monsanto hardness tester and the thickness of tablets was determined by VernierCallipers**(Cabiscolet al., 2018).**

6.2.3 Friability test:

Friability of a tablets can determine in a laboratory by Roche friabilator. The friabilator consists of plastic chamber that rotates at 25rpm, dropping the tablets through a distance of six inches in the friabilator, which is then operated for 100 revolutions. The tablets are reweighed. Compress tablets loss less than 0.5% to 1.0% of the tablet weight are considered acceptable.

This test was a time required for the tablet to separate into particles, the disintegration test measure only of the time required under a given set of a conditions for a group of tablets to disintegrate into particles. This test was performed to identify the disintegration of tablet in a specific time period**(Shimu, 2024).**

Advantages of tablet

- They are unit dosage forms and offer the greatest capabilities of all oral dosage forms for the greatest dose precision and the least content variability**(Mahato and Narang 2017).**
- Ease of accurate dose.
- Release rate of the drug from tablets can be tailored to meet pharmacological requirements**(Gerailiet al., 2021).**
- Easiest and cheapest to package and strip.
- Easy to swallow with least tendency for hang- up.
- Sustained release product is possible by enteric coating.
- Objectionable odour and bitter taste can be masked by coating technique.
- Greatest chemical and microbial stability over all oral dosage forms.
- Product identification is easy and rapid requiring no additional steps when employing an embossed and/or monogrammed punch face **(Darjiet al., 2018).**

Disadvantages of tablet

- Difficult to swallow in case of children and unconscious patients.

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- Some drugs resist compression into dense compacts, owing to their amorphous nature, low density character **(Al-Hmoudet al., 2020).**
- Drugs with poor wetting, slow dissolution properties, optimum absorption high in GIT may be difficult to formulate or manufacture as a tablet that will still provide adequate or full drug bioavailability.
- Bitter testing drugs, drugs with an objectionable odour or drugs that are sensitive to oxygen may require encapsulation or coating. In such cases, a capsule may offer the best and lowest cost **(Sanjay et al., 2025).**

VII. CONCLUSION

The present study successfully demonstrated the preparation, characterization, and development of a herbal tablet formulation containing active phytoconstituents for the effective management of gastric ulcers. The selected herbal extracts exhibited significant anti-ulcer potential, supported by their antioxidant and cytoprotective properties. The formulated tablets showed acceptable physicochemical characteristics, including optimal hardness, disintegration time, friability, and drug content uniformity, indicating good formulation stability and quality.

Phytochemical analysis confirmed the presence of key bioactive compounds responsible for the therapeutic effects, while in-vitro evaluation revealed promising anti-ulcer activity. The overall results suggest that the developed herbal-based tablet formulation can serve as a safe, effective, and economical alternative to conventional synthetic drugs, minimizing adverse effects and improving patient compliance. Further in-vivo studies and clinical evaluations are recommended to validate its efficacy and establish its therapeutic potential in the management of gastric ulcers.

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