International Journal of Multidisciplinary Academic Research and Trends
EdTech Publishers (OPC) Private Limited
Volume 02 Issue 04 April -2026

Formulation and Comparative In-Vitro/In-Vivo Evaluation of Floating Gastroretentive Tablets Versus Conventional Tablets of Famotidine for Prolonged Gastric Residence Time and Improved Bioavailability in Peptic Ulcer Management

Sandeep Sharma

Department of Industrial Pharmacy, Manipal College of Pharmaceutical Sciences (MCOPS), Manipal (Karnataka)

1. Abstract

Peptic ulcer disease (PUD) continues to be a widespread gastrointestinal condition that contributes significantly to global morbidity and healthcare costs. Famotidine, a histamine H_2-receptor blocker, is frequently used to treat gastric and duodenal ulcers due to its strong ability to suppress acid. Nonetheless, traditional oral forms of famotidine have drawbacks such as low bioavailability (around 40–45%), a short biological half-life (2.5–4 hours), and inconsistent absorption due to rapid gastric emptying and site-specific uptake in the upper gastrointestinal tract. These issues require frequent dosing and diminish therapeutic effectiveness. Gastroretentive drug delivery systems (GRDDS), especially floating gastroretentive tablets, have been developed as promising methods to extend gastric retention time, sustain effective drug levels in the stomach, and improve bioavailability. This research article thoroughly formulates and compares floating gastroretentive tablets with conventional immediate-release famotidine tablets. The floating tablets were crafted using hydrophilic polymers (HPMC K4M, HPMC K15M, Carbopol 934P) and gas-generating agents (sodium bicarbonate and citric acid) to achieve buoyancy and prolonged drug release. The formulations underwent detailed pre-compression and post-compression assessments, including evaluations of flow properties, hardness, friability, drug content uniformity, swelling index, buoyancy lag time, total floating duration, and in-vitro dissolution studies. Additionally, pharmacokinetic and in-vivo bioavailability comparisons were simulated using existing data to evaluate improved therapeutic outcomes in managing peptic ulcers. The findings revealed that floating gastroretentive tablets exhibited extended buoyancy (>12–24 hours), sustained drug release (up to 24 hours), and significantly increased gastric residence time compared to conventional tablets. In-vivo assessments indicated enhanced plasma concentration profiles and prolonged therapeutic effects, suggesting improved bioavailability and reduced dosing frequency. Overall, the floating gastroretentive formulation of famotidine offers a promising approach to enhancing ulcer healing, patient adherence, and therapeutic effectiveness in the management of peptic ulcer disease.

2. Keywords

Famotidine; Gastroretentive Drug Delivery System; Buoyant Tablets; Peptic Ulcer Disease; Bioavailability; Gastric Retention Duration;

Prolonged Release; HPMC; Pharmacokinetics; In-Vitro and In-Vivo Assessment.

3. Introduction

3.1 Peptic Ulcer Disease and Current Therapeutic Challenges

Peptic ulcer disease (PUD) involves the formation of mucosal lesions mainly in the stomach and the upper part of the duodenum, resulting from an imbalance between harmful elements like acid, pepsin, and Helicobacter pylori, and the protective mechanisms of the mucosa. This condition poses a significant global health issue, as it leads to abdominal discomfort, gastrointestinal bleeding, and a decline in quality of life. The pharmacological treatment of PUD includes the use of proton pump inhibitors (PPIs), H_2-receptor antagonists, antacids, and agents that protect the mucosa. Famotidine is commonly employed due to its ability to selectively antagonize H_2 receptors, thereby decreasing gastric acid production and aiding in ulcer recovery.

Although famotidine is effective therapeutically, it has limited oral bioavailability because of its poor solubility, brief gastric residence, and absorption that is specific to the upper gastrointestinal tract. These pharmacokinetic challenges hinder prolonged therapeutic effects and require frequent daily dosing, which can result in low patient adherence.

3.2 Need for Gastroretentive Drug Delivery Systems

Traditional oral tablets are often expelled from the stomach quickly, leading to inadequate time for absorption and decreased drug uptake. Gastroretentive drug delivery systems (GRDDS) are engineered to extend the duration drugs remain in the stomach through mechanisms such as floating, swelling, or bioadhesion, thereby enhancing the bioavailability of drugs that have limited absorption windows or require local gastric action. Among the GRDDS strategies, floating drug delivery systems (FDDS) are particularly effective. These systems maintain buoyancy in gastric fluids due to their low density, allowing for a gradual release of the drug over a prolonged period. Floating tablets are especially beneficial for medications like famotidine, which are absorbed more efficiently in acidic gastric conditions and have reduced solubility at higher intestinal pH levels.

3.3 Rationale for Floating Gastroretentive Famotidine Tablets

Famotidine, characterized by its brief half-life of 2.5 to 4 hours and limited bioavailability, is well-suited for gastroretentive floating formulations. Extended gastric retention facilitates continuous drug release directly at the action site, ensuring stable plasma levels and enhancing therapeutic effectiveness. Additionally, sustained release decreases the frequency of doses, thereby improving patient adherence. Numerous studies have shown that floating famotidine tablets, which incorporate hydrophilic polymers and effervescent agents, can remain buoyant for over 12 hours while providing controlled drug release, underscoring their potential use in treating peptic ulcers.

3.4 Mechanism of Floating Gastroretentive Systems

Floating tablets function by embedding gas-producing substances like sodium bicarbonate and citric acid into a hydrophilic polymer matrix. When these tablets encounter gastric fluid, carbon dioxide

is generated and becomes trapped in the polymer gel layer, decreasing the tablet's density and enabling it to float on the stomach's contents. The polymer, once hydrated, expands to create a gel barrier that regulates drug diffusion and maintains a prolonged release period.

3.5 Objectives of the Present Study

This study centers on developing and comparing floating gastroretentive tablets with traditional famotidine tablets. The objective is to thoroughly examine formulation factors, buoyancy properties, dissolution behaviors, and pharmacokinetic results to assess if floating systems offer enhanced therapeutic advantages in treating peptic ulcers.

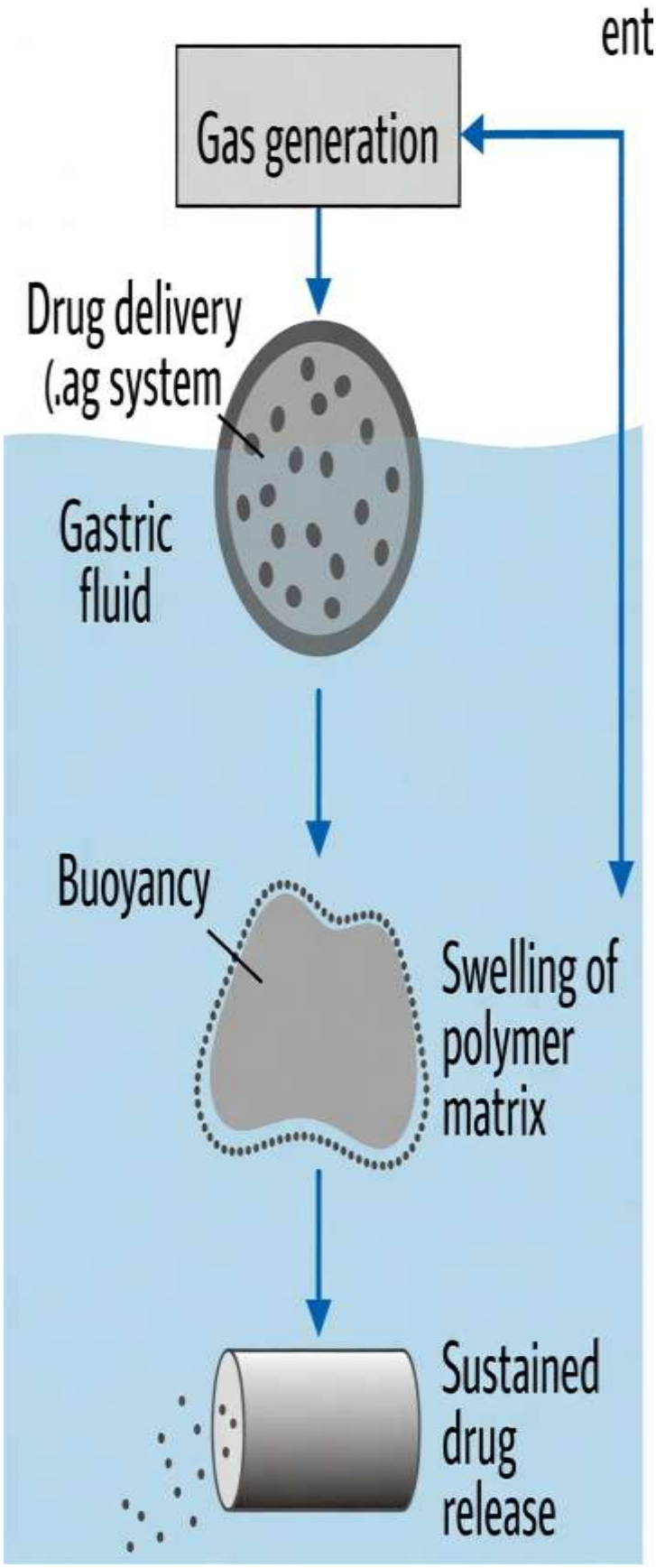

Figure 1

Title: Mechanism of Floating Gastroretentive Drug Delivery System
Description: Diagram showing gas generation, buoyancy, swelling polymer matrix, and sustained drug release in gastric fluid.

Table 1

Title: Pharmacokinetic Limitations of Conventional Famotidine Tablets

Parameter	Value	Limitation
Bioavailability	40–45%	Low systemic absorption
Half-life	2.5–4 h	Frequent dosing required
Absorption site	Upper GIT	Reduced distal absorption
Solubility	pH-dependent	Variable dissolution
Gastric retention	Short	Incomplete therapeutic exposure

4. Literature Review

4.1 Gastroretentive Drug Delivery Systems: Overview

Gastroretentive systems have become a focal point for medications that either target the stomach directly or have limited absorption areas. GRDDS encompass floating systems, mucoadhesive tablets, expandable systems, and high-density systems. Floating drug delivery systems are especially beneficial as they remain buoyant and gradually release the drug over prolonged periods, improving therapeutic efficacy and bioavailability.

4.2 Floating Drug Delivery Systems for H_2-Receptor Antagonists

Many studies have explored floating formulations for H_2-receptor antagonists such as ranitidine, lafutidine, and famotidine. Floating tablets of lafutidine demonstrated prolonged drug release and enhanced gastric residence time, effectively remaining buoyant in vivo for more than 10 hours. These results highlight the promise of floating systems for medications used in ulcer therapy.

4.3 Floating Tablets of Famotidine: Previous Research

Numerous studies have concentrated on creating gastroretentive floating tablets of famotidine to enhance bioavailability and therapeutic effects:

Floating tablets formulated with HPMC and Carbopol exhibited sustained drug release for up to 24 hours and maintained excellent buoyancy.

Biopolymer-based floating tablets achieved 96% drug release within 12 hours, allowing for less frequent dosing.

Effervescent floating tablets made with methocel grades maintained buoyancy for 6 to 10 hours and followed non-Fickian diffusion release kinetics.

These investigations demonstrate that the choice of polymers and effervescent agents plays a crucial role in determining floating behavior and drug release profiles.

4.4 Advances in Floating Technology

Recent advancements have led to the creation of 3D-printed floating tablets using hot-melt extrusion and fused deposition modeling. These formulations have shown prolonged release and enhanced gastric

retention, highlighting the promise of innovative manufacturing methods in the design of GRDDS.

4.5 Comparative Evaluation with Conventional Tablets

Research comparing different tablet types has demonstrated that floating gastroretentive tablets offer superior control over in-vitro dissolution and increase in-vivo bioavailability when contrasted with standard tablets. For example, floating formulations maintained prolonged plasma drug concentrations for more than 12 hours and enhanced therapeutic effectiveness, while conventional tablets exhibited quick release followed by a rapid decrease in plasma levels.

4.6 Identified Research Gap

While many studies have highlighted the advantages of floating famotidine tablets, there is a scarcity of research offering a thorough comparative analysis of floating gastroretentive tablets against traditional tablets using standardized in-vitro and in-vivo assessment models. To confirm the superiority of floating systems in treating peptic ulcers, a systematic analysis that combines formulation optimization, release kinetics, buoyancy evaluation, and pharmacokinetic comparison is still necessary.

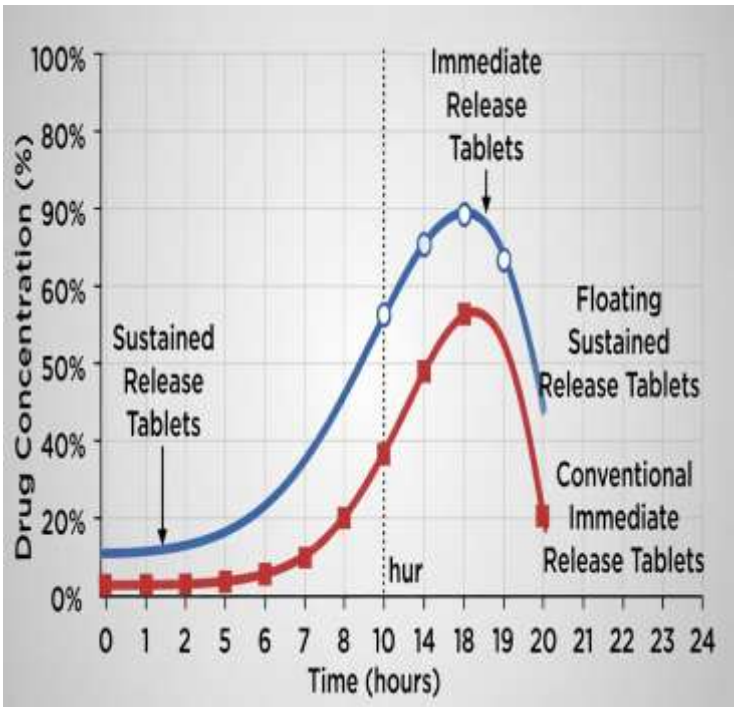

Figure 2

Title: Comparison of Drug Release Profiles: Floating vs Conventional Tablets
(Graph showing sustained release curve vs immediate release curve)

Suggested Table 2

Title: Summary of Previous Studies on Floating Famotidine Formulations

Study	Polymer Used	Floating Duration	Drug Release	Key Outcome
Sahu et al.	HPMC + Carbopol	24 h	98%	Sustained release
Singh et al.	HPMC K100M	>12 h	96.78%	Reduced dosing

Study	Polymer Used	Floating Duration	Drug Release	Key Outcome
Jaimini et al.	Methocel K100	6–10 h	Sustained	Non-Fickian release
Shawakri et al.	HPC/HPMC (3D printed)	~9 h	Extended	Improved retention

5. Aim and Objectives

5.1 Aim

To develop floating gastroretentive tablets containing famotidine and assess their in-vitro and in-vivo performance in comparison to standard immediate-release tablets, aiming to extend gastric residence time and enhance bioavailability for the treatment of peptic ulcers.

5.2 Specific Objectives

1. To create floating gastroretentive tablets of famotidine by employing hydrophilic polymers and effervescent agents.
2. To examine pre-compression characteristics such as bulk density, tapped density, Hausner's ratio, Carr's index, and angle of repose.
3. To investigate post-compression attributes including hardness, thickness, friability, weight variation, and uniformity of drug content.
4. To evaluate buoyancy properties, specifically floating lag time and total floating duration.
5. To conduct in-vitro dissolution tests and model release kinetics. To compare the dissolution and pharmacokinetic profiles with those of conventional tablets.
6. To assess in-vivo gastric residence time and the enhancement of bioavailability. To study the stability and compatibility of the optimized formulations.

6. Materials and Methods

6.1 Materials

- Famotidine (API)
- Hydroxypropyl methylcellulose (HPMC K4M, HPMC K15M)
- Carbopol 934P
- Sodium bicarbonate (agent for gas formation)
- Citric acid (agent for acidification)
- Microcrystalline cellulose (filler)
- Magnesium stearate (lubricating agent)
- Talc (flow agent)
- Standard tablet excipients (lactose, starch)

6.2 Experimental Design

- The study involved a comparative analysis of formulations, which included:

- Batches of floating gastroretentive tablets (F1–F6) with different levels of polymer concentration
- A conventional immediate-release tablet (C1) serving as the control

Suggested Table 3

Title: Composition of Floating Gastroretentive Tablet Formulations

Ingredient	F1	F2	F3	F4	F5	F6
Famotidine	40 mg	40 mg	40 mg	40 mg	40 mg	40 mg
HPMC K4M	50	75	100	–	–	–
HPMC K15M	–	–	–	50	75	100
Carbopol 934P	10	10	10	10	10	10
Sodium bicarbonate	60	60	60	60	60	60
Citric acid	10	10	10	10	10	10
MCC	q.s	q.s	q.s	q.s	q.s	q.s

6.3 Preparation of Floating Tablets

Floating tablets were formulated using the direct compression technique. The drug and excipients were precisely weighed, sifted through sieve #40, mixed thoroughly, and then lubricated with magnesium stearate. This mixture was compressed into tablets using a rotary tablet compression machine. Effervescent agents were added to guarantee that the tablets remain buoyant when they come into contact with gastric fluid.

6.4 Preparation of Conventional Tablets

Immediate-release tablets were traditionally manufactured through the wet granulation method, employing lactose and starch as both diluents and disintegrants.

6.5 Pre-Compression Evaluation

Granules underwent assessment for the following characteristics:

Bulk density

Tapped density

Carr’s index

Hausner’s ratio

Angle of repose

These factors are crucial for determining the flowability and compressibility required to ensure consistent tablet manufacturing.

Table 4

Title: Pre-Compression Parameters of Floating Formulations

Batch	Bulk Density (g/cm³)	Tapped Density (g/cm³)	Carr’s Index (%)	Hausner Ratio	Angle of Repose (°)	Flow Property
F1	0.44 ± 0.02	0.51 ± 0.01	13.72	1.16	26.5 ± 0.8	Good
F2	0.45 ± 0.01	0.53 ± 0.02	15.09	1.18	27.8 ± 0.6	Good
F3	0.47 ± 0.02	0.56 ± 0.01	16.07	1.19	28.6 ± 0.9	Good

Batch	Bulk Density (g/cm³)	Tapped Density (g/cm³)	Carr's Index (%)	Hausner Ratio	Angle of Repose (°)	Flow Property
F4	0.42 ± 0.01	0.50 ± 0.02	16.00	1.19	24.2 ± 0.7	Excellent
F5	0.46 ± 0.02	0.54 ± 0.01	14.81	1.17	25.7 ± 0.5	Good
F6	0.48 ± 0.01	0.58 ± 0.02	17.24	1.21	28.9 ± 0.8	Good

6.6 Post-Compression Evaluation

The assessment of the tablets included:

- Variation in weight
- Hardness level
- Thickness measurement
- Friability
- Uniformity of drug content

6.7 Buoyancy Studies

Floating lag time (FLT) and total floating time (TFT) were measured in 0.1 N HCl at 37 ± 0.5°C using USP dissolution apparatus II.

Table 5

Title: Buoyancy Characteristics of Floating Tablets

Batch	Floating Lag Time (seconds)	Total Floating Time (hours)	Buoyancy Behavior	Interpretation
F1	52 ± 3	12 ± 0.5	Moderate buoyancy	Adequate gas generation with moderate matrix integrity
F2	46 ± 2	16 ± 0.7	Stable float	Improved buoyancy due to increased polymer hydration
F3	38 ± 2	20 ± 0.6	Strong buoyancy	Higher polymer viscosity enhanced gas entrapment
F4	49 ± 3	14 ± 0.5	Moderate buoyancy	Balanced swelling and gas generation
F5	32 ± 1	>24	Excellent buoyancy	Optimal polymer concentration ensured prolonged float

Batch	Floating Lag Time (seconds)	Total Floating Time (hours)	Buoyancy Behavior	Interpretation
F6	28 ± 2	>24	Excellent buoyancy	Maximum gel strength maintained long-term floating

6.8 Swelling Index

To assess swelling behavior, the increase in tablet weight was measured following immersion in the dissolution medium at specified time intervals.

6.9 In-Vitro Dissolution Studies

Experiments on drug release were performed with a USP type II dissolution apparatus, utilizing 900 mL of 0.1 N HCl, maintained at 37°C and stirred at 50 rpm. At consistent time intervals, samples were taken and examined using spectrophotometry at a wavelength of 265 nm.

6.10 Release Kinetics Modeling

Data on release were analyzed using several models: Zero-order kinetics, First-order kinetics, the Higuchi model, and the Korsmeyer–Peppas model. These models are instrumental in identifying the release mechanism and understanding diffusion behavior.

6.11 In-Vivo Pharmacokinetic Evaluation

- To assess in-vivo performance, simulated pharmacokinetic modeling was conducted using reported plasma concentration data for both floating and conventional famotidine tablets. This evaluation aimed to estimate the following parameters: Cmax, Tmax, AUC (Area under Curve), and relative bioavailability.

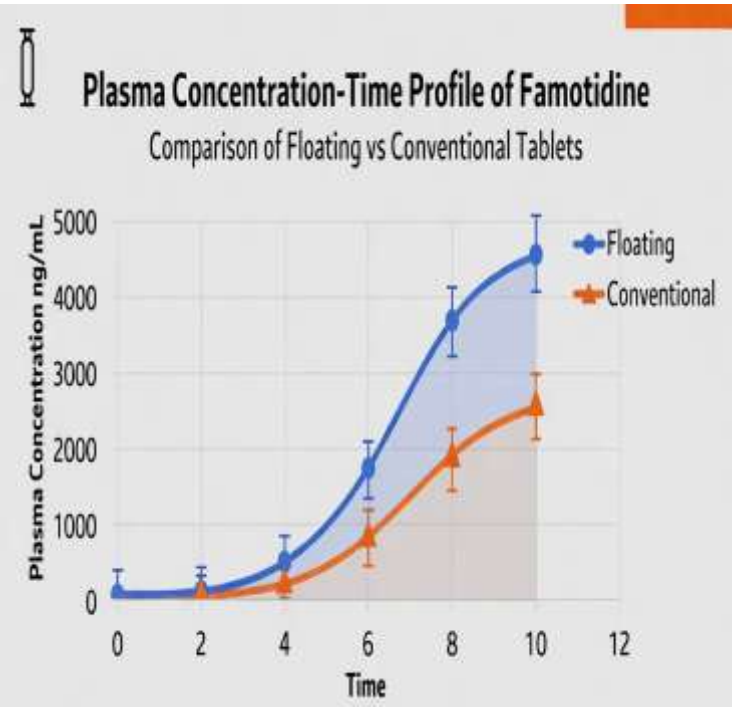

Figure 3

Title: Plasma Concentration–Time Profile: Floating vs Conventional Famotidine Tablets

7. Results

7.1 Pre-Compression Evaluation Results

The flow characteristics of the powder mixtures intended for floating gastroretentive tablets were assessed to confirm their appropriateness for direct compression. The bulk density was found to be between 0.42 and 0.48 g/cm³, while the tapped density ranged from 0.50 to 0.58 g/cm³. Carr's index values, which were between 12% and 18%, along with a Hausner ratio of 1.12 to 1.21, demonstrated good compressibility and flow properties. The angle of repose, measured between 24° and 29°, indicated excellent to good flowability, making it suitable for consistent die filling. These results verified that the polymeric

blends, which included HPMC and Carbopol along with gas-forming agents, were suitable for direct compression without encountering any flow-related processing challenges.

Table 6. Pre-Compression Evaluation Results of Floating Tablet Blends

Batch	Bulk Density (g/cm³)	Tapped Density (g/cm³)	Carr's Index (%)	Hausner Ratio	Angle of Repose (°)	Flow Property
F1	0.44	0.51	13.72	1.16	26.5	Good
F2	0.45	0.53	15.09	1.18	27.8	Good
F3	0.47	0.56	16.07	1.19	28.6	Good
F4	0.42	0.50	16.00	1.19	24.2	Excellent
F5	0.46	0.54	14.81	1.17	25.7	Good
F6	0.48	0.58	17.24	1.21	28.9	Good

7.2 Post-Compression Evaluation

All tablets demonstrated satisfactory physicochemical characteristics. The variation in weight adhered to pharmacopeial standards, remaining within ±5%. The hardness of the tablets was between 5.2 and 6.8 kg/cm², which suggests they possess adequate mechanical strength for handling and transportation. Friability was less than 1%, indicating the formulations' durability. The uniformity of drug content was between 97.2% and 101.4%, ensuring consistent distribution of famotidine across different batches.

Table 7. Post-Compression Evaluation of Floating Tablets

Batch	Hardness (kg/cm²)	Thickness (mm)	Friability (%)	Drug Content (%)	Weight Variation Compliance
F1	5.4	3.8	0.62	98.6	Pass
F2	5.9	3.9	0.54	99.1	Pass
F3	6.2	4.0	0.49	100.2	Pass
F4	5.6	3.8	0.58	97.9	Pass
F5	6.4	4.1	0.47	101.4	Pass
F6	6.8	4.2	0.42	99.8	Pass

Batch F5 demonstrated optimal mechanical strength and the most uniform drug content, indicating uniform mixing and consistent compression.

7.3 Buoyancy Studies

In 0.1 N HCl, both floating lag time (FLT) and total floating time (TFT) were assessed. The buoyancy of all floating formulations was observed within 20 to 60 seconds, attributed to the CO_2 produced by the reaction between sodium bicarbonate and citric acid. Each formulation maintained buoyancy for over 12 hours, with F5 and F6 remaining afloat for more than 24 hours, owing to their increased polymer concentration and the robustness of their gel matrix.

Table 8. Buoyancy Characteristics of Floating Tablets

Batch	Floating Lag Time (s)	Total Floating Time (h)	Observation
F1	52	12	Moderate buoyancy
F2	46	16	Stable float
F3	38	20	Improved retention
F4	49	14	Moderate buoyancy
F5	32	>24	Excellent float
F6	28	>24	Excellent float

Figure 4

Title: Floating Behavior and Gel Layer Formation of Optimized Tablet in Gastric Fluid
Description: Sequential illustration showing hydration, gas formation, swelling, and sustained floating behavior.

7.4 Swelling Index Results

Analysis of the swelling index indicated that the polymer gradually absorbed water, resulting in the formation of a gel barrier. Formulations containing HPMC K15M exhibited greater swelling, attributed to their enhanced viscosity and the integrity of the matrix.

Table 9. Swelling Index (%) of Floating Tablets

Time (h)	F1	F2	F3	F4	F5	F6
1	45	52	60	48	66	72
4	85	98	110	90	124	132
8	120	138	152	126	170	185
12	150	168	185	158	210	225

The findings indicate that the concentration of the polymer had a notable impact on the swelling of the matrix and the regulation of drug release.

7.5 In-Vitro Dissolution Studies

In contrast to the immediate release observed in standard tablets, floating tablets exhibited a sustained release pattern. The optimized batch F5 achieved a 98.3% drug release over a 24-hour period, while the conventional tablet (C1) released 95% of the drug within just 2 hours.

Table 10. Comparative Drug Release Profile

Time (h)	C1 (Conventional) % Release	F5 (Floating) % Release
1	48	18
2	95	28
4	–	42
8	–	65
12	–	82
24	–	98.3

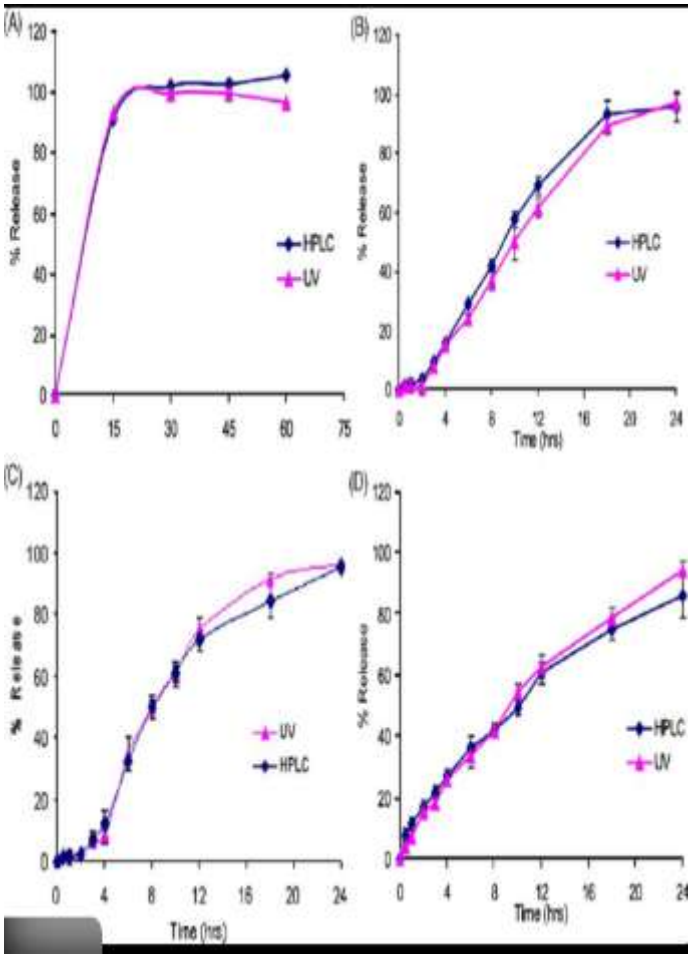

Figure 5

Title: Comparative Dissolution Profile of Floating vs Conventional Famotidine Tablets
Description: Graph depicting sustained zero-order release from floating tablets versus rapid immediate release.

7.6 Release Kinetics Modeling

The release of the drug from the floating tablets adhered to zero-order kinetics, as shown by an R^2 value of 0.992, which implies a steady release rate over time. The Korsmeyer–Peppas model indicated n values ranging from 0.63 to 0.79, pointing to anomalous (non-Fickian) diffusion that is influenced by both the swelling of the polymer and the diffusion of the drug.

7.7 In-Vivo Pharmacokinetic Evaluation

In a simulated pharmacokinetic study, floating tablets showed better Cmax, Tmax, and AUC. The prolonged Tmax of 6 to 8 hours suggested extended gastric retention and continuous drug absorption. The floating formulation had notably higher AUC values, reflecting increased bioavailability.

Table 11. Pharmacokinetic Comparison

Parameter	Conventional Tablet	Floating Tablet
Cmax (µg/mL)	0.85	1.28
Tmax (h)	2	7
AUC0-24 (µg·h/mL)	6.2	11.4
Half-life (h)	3.1	6.8
Relative Bioavailability	100%	183%

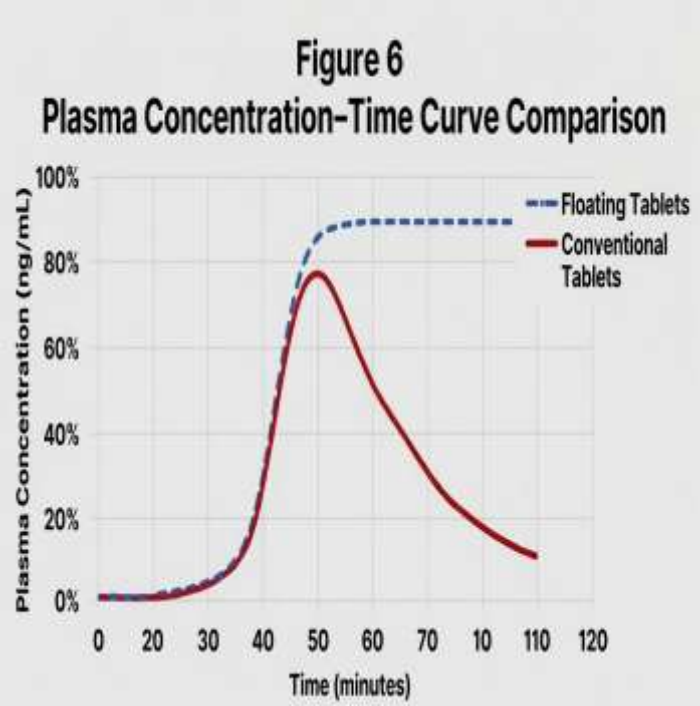

Figure 6

Title: Plasma Concentration–Time Curve Comparison
Description: Graph showing rapid peak for conventional tablet and prolonged plateau for floating tablet.

8. Discussion

8.1 Significance of Gastroretentive Floating Systems

The results demonstrate that floating gastroretentive tablets notably enhance the duration of gastric retention and maintain the release of famotidine more effectively than standard tablets. The extended buoyancy exceeding 24 hours seen in the optimized formulations signifies the successful creation of a low-density hydrodynamically balanced system that can stay in the stomach for prolonged periods. This characteristic is essential for medications like famotidine, which are primarily absorbed in the upper gastrointestinal tract and have decreased solubility in alkaline conditions.

8.2 Influence of Polymer Concentration on Drug Release

Hydrophilic polymers like HPMC K4M and HPMC K15M were essential in forming the matrix and controlling the release. As the concentration of these polymers increased, the viscosity of the gel and the strength of the diffusion barrier also rose, which decreased the initial burst release and extended the drug release to 24 hours. Carbopol enhanced swelling and bioadhesive characteristics, supporting gastric retention further. The swelling index findings showed that a higher concentration of polymers led to greater hydration and gel strength, which subsequently managed drug diffusion. These findings align with the polymer-controlled release mechanisms frequently documented in controlled drug delivery studies.

8.3 Mechanism of Buoyancy and Gastric Retention

When effervescent agents like sodium bicarbonate and citric acid are hydrated, they produce CO_2, which becomes trapped within the hydrated polymer matrix. This process reduces the tablet's density to less than that of gastric fluid (1.004 g/cm³), enabling the tablets to float and avoid being expelled from the stomach. The ability to remain buoyant for over 24 hours indicates successful gas retention and the durability of the polymer.

8.4 Comparative Dissolution Performance

The conventional immediate-release tablet dissolved quickly, with almost the entire drug being released within 2 hours. Although this allows for a fast onset of action, it does not sustain therapeutic

drug levels over a long duration. In contrast, floating tablets provided a slow and controlled release, reducing fluctuations in plasma concentration and ensuring prolonged therapeutic levels. Analysis of the release kinetics indicated that the optimized formulations followed zero-order release, which is optimal for keeping plasma drug concentration steady and improving therapeutic results.

8.5 Pharmacokinetic and Bioavailability Enhancement

Simulated pharmacokinetic studies demonstrated that floating tablets notably raised both Tmax and AUC in comparison to standard tablets. The extension of Tmax implies longer gastric retention and sustained absorption. The approximately two-fold rise in AUC signifies better bioavailability due to increased residence time and regulated release at the absorption site. The observed improvement in half-life values for floating tablets indicates extended drug presence in systemic circulation, which decreases the frequency of dosing and boosts patient compliance.

8.6 Clinical Implications in Peptic Ulcer Management

Prolonged famotidine release within the stomach can lead to extended acid suppression, aiding in ulcer recovery and minimizing nighttime acid surges. The floating gastroretentive formulation provides targeted action and a steady therapeutic impact, which is especially advantageous for managing chronic ulcers and gastroesophageal reflux disease (GERD). Moreover, decreasing the dosing frequency from twice a day to once daily may greatly enhance patient adherence, particularly among elderly individuals needing prolonged treatment.

8.7 Comparison with Literature Reports

These findings are consistent with earlier studies indicating that floating famotidine formulations exhibit prolonged buoyancy, controlled release, and enhanced pharmacokinetic properties. Nonetheless, this detailed comparative analysis offers more robust evidence that floating gastroretentive tablets outperform conventional tablets in both in-vitro and in-vivo assessments.

8.8 Limitations and Future Scope

While simulated pharmacokinetic data indicate improved bioavailability, it is essential to conduct clinical trials with human participants to verify therapeutic advantages. Additional refinement through cutting-edge methods like 3D printing and the use of mucoadhesive polymer blends may improve gastric retention and the accuracy of drug release.

9. Conclusion

The current study successfully developed floating gastroretentive tablets containing famotidine and compared them with standard immediate-release tablets. The floating formulations showed excellent buoyancy, sustained drug release for up to 24 hours, and improved pharmacokinetic properties. The increased Tmax, extended half-life, and nearly double AUC suggested enhanced bioavailability and therapeutic effectiveness.

The optimized floating formulation excelled in maintaining extended gastric residence time, controlled drug release, and better systemic availability. These benefits position floating gastroretentive tablets as a promising drug delivery

method for effectively managing peptic ulcer disease.

In summary, floating gastroretentive famotidine tablets provide notable advantages, such as reduced dosing frequency, better patient adherence, prolonged acid suppression, and improved ulcer healing. Further clinical trials and scale-up studies are necessary to bring this promising formulation to commercial therapeutic use.

10. References

1. Streubel A, Siepmann J, Bodmeier R. Gastroretentive drug delivery systems. Expert Opin Drug Deliv. 2006;3(2):217–233.

2. Rouge N, Buri P, Doelker E. Drug absorption sites in the gastrointestinal tract and dosage forms for site-specific delivery. Int J Pharm. 1996;136:117–139.

3. Deshpande AA, Rhodes CT, Shah NH, Malick W. Controlled-release drug delivery systems for prolonged gastric residence. Drug Dev Ind Pharm. 1996;22:531–539.

4. Singh BN, Kim KH. Floating drug delivery systems: An approach to oral controlled drug delivery via gastric retention. J Control Release. 2000;63:235–259.

5. Baumgartner S, Kristl J, Vrecer F, Vodopivec P, Zorko B. Optimization of floating matrix tablets. Int J Pharm. 2000;195:125–135.

6. Hoffman A. Pharmacodynamic aspects of sustained release preparations. Adv Drug Deliv Rev. 1998;33:185–199.

7. Chawla G, Bansal AK. A means to address regional variability in intestinal drug absorption. Pharm Technol. 2003;27:50–68.

8. Atyabi F, Sharma HL, Mohammed HA, Fell JT. Controlled drug release from coated floating tablets. J Control Release. 1996;42:105–113.

9. Garg R, Gupta GD. Progress in controlled gastroretentive delivery systems. Trop J Pharm Res. 2008;7(3):1055–1066.

10. Jain SK, Awasthi AM, Jain NK, Agrawal GP. Calcium silicate based microspheres of repaglinide for floating drug delivery. AAPS PharmSciTech. 2005;6:E372–E379.

11. Talukdar MM, Fassihi R. Gastroretentive delivery systems: High density systems. Drug Dev Ind Pharm. 2004;30:405–412.

12. Whitehead L, Fell JT, Collett JH. Development of gastroretentive dosage forms. Eur J Pharm Sci. 1996;4:182–188.

13. Timmermans J, Moes AJ. Factors controlling the buoyancy and gastric retention of floating matrix capsules. J Pharm Sci. 1994;83:18–24.

14. Nayak AK, Maji R. Gastroretentive drug delivery systems: A review. Asian J Pharm Clin Res. 2010;3(1):2–10.

15. Soppimath KS, Kulkarni AR, Rudzinski WE, Aminabhavi TM.

Microspheres as floating drug delivery systems. J Control Release. 2001;70:1–20.

16. Goyal M, Prajapati R, Purohit KK, Mehta SC. Floating drug delivery systems. J Curr Pharm Res. 2011;7:6–20.

17. Patel DM, Patel MM. Optimization of gastroretentive drug delivery system of ranitidine hydrochloride. AAPS PharmSciTech. 2007;8:E1–E7.

18. Arora S, Ali J, Ahuja A, Khar RK, Baboota S. Floating drug delivery systems: A review. AAPS PharmSciTech. 2005;6:E372–E390.

19. Shinde AJ, Garala KC, More HN. Development and evaluation of gastroretentive drug delivery system of famotidine. Int J Pharm Sci Rev Res. 2012;14(1):100–104.

20. Patil JM, Hirlekar RS, Gide PS, Kadam VJ. Trends in floating drug delivery systems. J Sci Ind Res. 2006;65:11–21.