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Review Article

Gastroretentive Floating Tablets: Formulation And Evaluation For Site-Specific Delivery

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ABSTRACT

A macrolide antibiotic called "selected drug" is frequently used to treat a variety of bacterial infections, including those brought on by Helicobacter pylori, which is linked to gastritis and peptic ulcers. [1] Even if the medicine is efficacious, its short gastric residence time and variable bioavailability due to rapid gastric emptying can seriously impair its therapeutic efficacy. Conventional oral formulations might not keep the stomach's drug levels high enough, which would result in less than ideal therapeutic results. However, quick stomach emptying may reduce its bioavailability. The therapeutic efficacy of the medication can be increased by using a gastro retentive floating tablet [2] (GFT) to lengthen the drug's retention period in the stomach. The goal of this research is to use statistical techniques to formulate and optimize a particular medicine GFT and assess its efficacy through in vitro experiments.

INTRODUCTION

Drug delivery systems known as gastro-retentive ones are designed to keep delivered medications in the stomach area for several hours, increasing patient compliance and potentially improving the solubility and bioavailability of difficult-to-take medications. The principle of mucoadhesion, flotation, and sedimentation being delayed by gastric emptying promotes the gastro-retentive drug delivery systems

1. Thus, by lengthening the duration of contact between the medication and the mucosa of the small intestine, gastro-retentive drug delivery devices improve the absorption of medications in the gastrointestinal tract. In turn, drug delivery methods based on gastric retention offer more recent treatment options. Drug waste could be decreased by using gastro retentive drug delivery methods. Drug delivery methods that are gastro-retentive minimize variations in plasma and minimize dosage frequency while providing a regulated drug delivery

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profile with an effective plasma drug concentration.

2. Medications with low absorption in the lower GIT, instability, poor solubility at alkaline pH, short half-life, and local action at the upper section of the gut 3 are good candidates for gastro retentive drug delivery formulations.
3. Gastro retentive drug delivery formulations reduce mucosal irritation as a result of their sustained/controlled release effect, which can help achieve the appropriate plasma drug concentration and avoid medication variations without leading to dosage dumping. This method can also be used to distribute unstable medications.

The longer stomach residence time, low-density (floating), high-density (sinking), expandable (swelling), and mucoadhesive systems are among the different techniques used in gastro retentive drug delivery systems.

Reason #3 for GRDDS:

Conventional oral delivery is frequently utilized in the pharmaceutical industry to cure illnesses. However, there are a number of problems with traditional delivery, the main one being non-site specificity.

Certain medications only absorb at a particular location.

- The pharmaceutical industry is currently concentrating on these medications that need to be site-specific.
- The medication is taken by keeping the dosage form in the stomach, and it is then released gradually into the stomach, duodenum, or intestine at a designated location.

Absorption window concept: regional variations in intestinal absorption [4]

The gastrointestinal tract (GIT) provides a diverse environment that can impact the absorption of medications taken orally. Anatomical characteristics, physiological processes, and the composition of the gut environment all contribute to these alterations. This may result in differences in the intestinal permeability of drug molecules, which may then cause the "absorption window" phenomenon, in which a medication is only selectively absorbed from a certain area of the gastrointestinal tract. Not every drug candidate absorbs evenly throughout the gastrointestinal tract. Regional variability in intestinal absorption refers to the effects of drugs that demonstrate variation in absorption from different sections of the GI tract or absorption from only one specific location. These medications have a "absorption window," which denotes the portion of the GI tract where absorption happens most frequently. The following circumstances lead to the observation of this absorption window [5,6].

1. Physicochemical factors: a. solubility depending on pH; b. stability dependent on pH; c. enzyme-induced degradation
2. Anatomical elements

A. Absorption mechanism

B. Intestinal microflora degradation

1. Chemical and physical aspects pH-dependent solubility and stability: For a medication to effectively pass biological membranes, it must be in a solubilized and stable state. The pH range of a medicine throughout the GIT is 1 to 8. The majority of medications are absorbed passively in their unionized state, and the degree of ionization at varying pH levels in various GIT areas can drastically change the absorption profile. pH dependent solubility, stability and ionization by changing the physical characteristics of the medication in different regions of the GIT can lead to regional variations in absorption of pharmaceuticals
2. Anatomical elements A medication taken orally undergoes specific physiological changes that may influence the absorption window. The absorption mechanism: Drugs

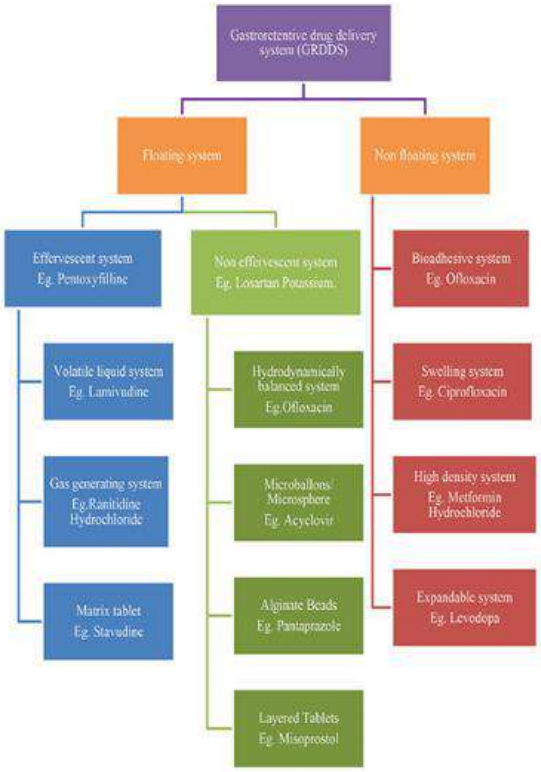
taken orally are absorbed through non-passive absorption methods in addition to passive diffusion. Because active and assisted transport pathways are more common in a given GIT region, drugs that are absorbed through these mechanisms exhibit more regional specificity.

Enzymes involved in metabolism:

The presence of specific enzymes in a given GIT region may also cause regional variations in the absorption of medications that act as substrates for those enzymes. intestinal metabolic enzymes (majorly, phase one), like cytochrome P-450 (e.g. CYP3A) are abundantly expressed in the intestinal epithelium. metabolism on the first pass Another significant factor influencing the decrease in the bioavailability of medicines taken orally is hepatic first-pass metabolism. The portal veins transport the majority of medications ingested from the intestines to the liver, which may be the site of drug processing. Conversely, for medications whose hepatic metabolism is critical to their therapeutic effect, hepatic first-pass metabolism is of great importance. It is commonly acknowledged that solid, oral controlled release dose forms provide challenges in terms of accurately predicting the actual in vivo timing of release. As a result, under some conditions, drug absorption in the gastrointestinal (GI) tract can be extremely varied and brief. "The goal of the oral controlled release dosage form is to extend the residence time in the absorption region for the desired period of time, in addition to prolonging the drug delivery for more than 12 hours." Recent research and patent literature make clear that there is growing interest in innovative dosage forms that remain in the stomach for an extended and consistent amount of time. Controlling the gastric residence time (GRT) is one of the most practical methods for attaining a longer and consistent medication delivery profile in the GI tract. Gastro retentive dosage forms (GRDF), or dosage forms with an extended GRT, will provide us significant new therapeutic possibilities. The length of time over which the medications may be released is greatly extended by GRDF. Consequently, compared to the current controlled release dose forms, they not only boost patient compliance but also lengthen treatment intervals.

GRDDS classification:

The two primary categories of GRDDS are floating and non-floating systems. The GRDDS is categorized into four groups for non-floating systems according on the mechanism utilized for gastro retention, while floating systems are further divided into effervescent and non-effervescent systems based on the four floating mechanisms.



1. A drug delivery system that floats [7]

Sir Davis first proposed the floating medication delivery device in 1968. The floating drug delivery system delivers the medicine in a controlled manner because its bulk density is lower than that of gastric fluid, allowing it to stay in the stomach or other targeted place for longer. Over an extended period of time, the rate of stomach emptying is unaffected by floating medication administration. [8] The medication is released in the stomach once the residual system is gastrically empty. Enhance the drug's bioavailability, regulate its plasma levels, and lengthen its stomach retention period.

The following are the characteristics of FDDS:

- Slow drug release;
- Drug reservoir;
- Bulk density that should be lower than that of stomach fluid (1.004–1.0 gm/cm).
- Must form a cohesive gel barrier

i) System Effervescent [9]

Swellable polymers like tartaric acid, HPMC, chitosan, and effervescent compounds like citric acid and sodium bicarbonate are used to form the effervescent system matrix. In the GIT, effervescent preparation may improve the pH of the stomach and absorption. The effervescent tablet has a higher bioavailability than a regular tablet. A tablet that contains sodium bicarbonate, tartaric acid, or citric acid and undergoes a reaction in the stomach to release carbon dioxide is known as an effervescent dosage form. The effervescent lessens the density of the tablet dosage form, allowing it to float over stomach gastric juice. Citric acid is applied to sodium bicarbonate in a 0:76:1 ratio to produce effervescent (carbon dioxide). In effervescent system drug are held in reservoir, drug release in control or sustain manner when effervescent are formed in gastric fluid.

(a) Gas Production System

The effervescent system includes the gas generating system. As a result, this system also produces carbon dioxide through the effervescent reaction between citric acid and sodium bicarbonate. When the medication is trapped in a hydrocolloid layer, it loses some of its specific

gravity and density, causing it to float above the stomach contents following gas releases, gas generation, or carbon dioxide production (effervescent). [10]

(b) Vacuum or volatile liquid system

Recent developments in the gastro-retentive medication delivery system include the volatile liquid and vacuum system. This device consists of an inflatable chamber that is filled with body-temperature gasified volatile oils, such as cyclopentane and ether. The volatile liquid releases first, followed by the medication. Moreover, a bio erodible polymer plug made of polyvinyl alcohol, polyethylene, etc., may be used to fill the inflatable chamber. [11]

ii) Non-Effervescent Mechanism

Non-effervescent systems are made using matrix-forming polymers like polymethacrylate, polyacrylate, and polystyrene, as well as highly swellable and gel-forming chemicals like hydrocolloids and polysaccharide. When an oral non-effervescent medication (dosage form tablet, capsule, or pellet) comes into touch with the gastric fluid in the stomach, which has a pH range of 1 to 3, it swells and becomes bulky, losing less than 1 of its density. The non-effervescent dosage form's gel-formed structure functions as a reservoir, allowing the material to release gradually over an extended period of time. When non-effervescent dosage forms react with gastric fluid, they swell significantly or multiple times more than other oral dosage forms. The best non-effervescent methods are porous and present on the surface. An osmatic situation is generated. As a result, the dose form is forced into the stomach's pylorus by the stomach's gastric concentration; but, as the stomach's size increases, the pressure through it is forced back to the surface. As a result, dosage forms have excellent absorption and float on the surface of stomach fluid with a gradual release of medication. [12]

iii) Forming Rafts

Treatment for gastric esophageal reflux disease, or GERD, is the primary usage of the raft forming system. When the raft-forming mechanism comes into touch with stomach fluid, a viscous cohesive gel forms. Because of this, a portion of the liquid gel swells overall and forms a continuous layer on the surface of the stomach fluid known as a raft. Raft forming systems contain bicarbonate and carbonate, which makes dosage forms bulky and causes them to release carbon dioxide, which reduces system density. Sodium alginate, the gel-forming ingredient in the raft-forming mechanism, reacts with gastric fluid to produce rafts and also stops stomach contents from refluxing into the esophagus. [13]

2. Non-Floating Medication Delivery Mechanism

The dosage form of a gastro-retentive drug delivery system does not float in the stomach in a non-floating drug delivery system; rather, it remains in the stomach through a different process. The medication may settle in the stomach, exhibiting mucoadhesive and bioadhesive qualities. This dosage form release medicine sustainably and at the intended place; additionally, it is a pH-dependent drug delivery system that dissolves at a specific pH.[14,15] Additional non-floating system techniques are split into

i) System of High Density

When a patient receives a high density dose form (capsule, tablet, or pellet) orally, the medication sinks to the bottom of the stomach after becoming caught in the antrum and resisting the peristaltic wave of the stomach wall. High density drug delivery systems are prepared by either combining pharmaceutical preparation with inert material or covering a layer of heavy metal. The inert materials, which can include titanium oxide, zinc oxide, barium sulphate, and oxides, are combined with pharmaceutical preparations (dosage forms) to create a formulation that is denser than typical

stomach contents. The inert ingredient raises the density to 1.5–2.4 gm/cm3, depending on the density found in the stomach. Because the pellets are small, their transit duration can range from 6 to 24 hours, and their rate of dispersion falls. Because the high-density system's product is ineffectual in people while research and development is being done on it, it is not currently on the market.

ii) The Magnetic System

A tiny magnet is placed in the dose form and over the position in the belly when using a magnetic system. An additional magnet can be added to a dosage form to extend its stomach residence period. Drug absorption may continue for a while. Ten rabbits were used in the initial technological trial, which used bio adhesive granules containing ultra-fine ferrite. Granule where moved to esophagus with an external magnet of 1700 G for the initial 2 min and (interval of 2 min) practically all the granules were kept in the region after 2 – 10 hrs.[16]

iii) System of Mucoadhesive and Bioadhesive

Lumen is employed as a drug delivery mechanism in bio adhesive drug delivery systems to improve drug absorption at the intended spot. Adhesive polymers are used in this technique to stick to the stomach's epithelial surface and extend drug absorption. Because gastrointestinal mucous often releases mucous, mucoadhesive is not as strong an adhesive as bioadhesive. Dilution of stomach contents (gastric fluid) is required to address those defects. Certain excipients, such as lectins, carbopol, chitosan, glidin, etc., are utilized to have a complete adhere in the mucosal membrane; these excipients aid to boost absorption for a longer period of time in the stomach and GI track. Targeted and site-specific medication delivery is another foundation of this approach.[17]

iv) Hydrogel System with Superpores

Because of the time constraints, the super pores hydrogel system's linked microscopic pores are what allow water to be absorbed quickly. As a result, the system's water absorption capacity should be large. The interconnected network of hydrophilic polymer that makes up the super porous hydrogel system causes capillary action, which results in swelling of the dosage form. [18] Ingredients like stabilizer, foaming agent, foaming aid, and cross linker are mixed with diluent water to create the super porous hydrogel system. The super pore hydrogel system is stable in stomach acidic conditions, has a high mechanical strength, and swells quickly. To increase gastric retention duration, pore sizes with an average of 100 micrometers are employed.

v) System for expanding, unfolding, and ballooning

The dosage size rises in these medication delivery methods as the dosage form reacts with the stomach juice. Expandable agents that cause swelling, such gel, cellulose, HPMC, etc., are what cause the swelling because they allow water or stomach fluid to be absorbed through osmatic absorption. When the dosage form is administered orally, it should initially be in normal condition. This is because the dosage form undergoes a stomach reaction, causing it to inflate and float to the top. [19] Expendable unfoldable and swelling system have lately explored and produced and are seen effective GRDDS. Because biodegradable polymer comes in a variety of sizes and is easily compressed inside capsules to expand in the stomach by osmatic absorption of water, it is typically used in unfoldable systems. This technology has also reported several disadvantage such as easy storage of hydro sable, biodegradable, etc., short mechanical shape. Because the unfolding mechanism is cost-effective, drug delivery may result in temporary blockage, intestinal adhesion, and gastropathy, making industrialization challenging.

The following criteria must be met in order to build an expendable system:

- The dose form should be small (normal) for oral intake.
- Expanded Gastro retentive form;
- Is unlikely to destroy stomach tissue
- Eventually, as the drug substance is removed from the system, it should shrink.

Benefits of GRDDS [20]

1. Increases a drug's bioavailability for metabolization in the upper portion of the gastrointestinal tract.
2. Lowers the frequency of dose for the medication with a relatively short half-life, which enhances patient compliance.
3. Extended and continuous medication release promotes a localized therapeutic response in the stomach and upper small intestine.
4. Sufficient physiological activity at the location of action is ensured by controlled drug release.
5. Less variation in the drug's plasma concentration, preventing concentration-dependent side effects 6. By lessening variations in the drug's plasma concentration, the receptor can be more selectively activated (Dosage form).

Restrictions

1. Not appropriate for medications with low acid solubility. For instance, phenytoin
2. Inappropriate for medications that become unstable in an acidic environment. For instance, erythromycin
3. Slow-release medications that irritate the stomach or create sores there. Such are NSAIDs and aspirin
4. Medication that the colon preferentially absorbs. For instance, corticosteroid
5. To float and function properly, floating medicine delivery devices need a high fluid level in the stomach.

Uses:

1. Increased bioavailability
2. Continuous administration of medication
3. A medication delivery system tailored to a particular site
4. Improvement of absorption
5. Lessened harmful activities in the colon
6. Less variation in medication concentration

Variables Impacting the Gastro-Retentive Time [21]

1. Particle Size:

The intestinal membrane is reached by particles with a size range of 1 to 2 micrometers (mm).

2. Density: -

The dosage's density influences the rate or duration of stomach emptying.

3. Dosage form size: -

The dosage form's particle size must be greater than 7.5 mm in diameter for extended GRT.

4. Dosage form shape:

A better GRT of 90 to 100% can be attributed to dosage form shapes. In contrast to other forms of dosing, the devices in question are tetrahedron-shaped rings.

5. Food's Nature: -

Some food ingredients make it an indigestible polymer, which influences the pattern of stomach motility.

6. Food temperature: -

The food's temperature slowed down the rate at which the stomach was emptied.

7. Calorie content of the food:

Foods high in fat or protein have the ability to prolong the period that food remains in the stomach (4 to 10 hours).

8. Frequency of feeding: -

A high frequency of feeding results in a 400-minute stomach gastric retention period.

9. Gender: -

With respect to the patient's height, weight, and body surface, the gastric retention period is 4-6 hours for females and 3–4 hours for males.

10. Age: -

The GRT is significantly longer for those over 70.

11. Poster

12. Posture of the patient may affect GRT.
13. Concomitant drug administration: - Narcotic analgesics, opiates, and antacids like aluminium hydroxide, as well as anticholinergic drugs like atropine, may accelerate and prolong GRT.

Materials:

Unique polymer employed in FDDS

Sustained release polymers	HPMC K100M, HPMC K15M, HPMC elv, Polycarbonate, Polyethylene Glycol, SodiumAlginate, Carbopol, Eudragit.
Effervescent generating system	Citric Acid, Tartaric Acid, Sodium Bicarbonate, Citroglycine.
Polymers which increase buoyancy	Ethyl Cellulose44
Polymers which decrease release	Talc, Magnesium Stearate, Dicalcium, Phosphate.
Polymers which increase release	Mannitol, Lactose
Inert polymers	Long chain fatty alcohol, fatty acid, beeswax.
Plasticizer	Glycerol, Propylene Glycol, Polyrthylene Glycol, Diethyl Phthalate, Actetylated Monoglycerides.
Polymers with low density	Foam powder of polypropylene.

Methods for Creating a Floating Medication Delivery System 22

Regarding Single Unit Dosage Forms, such as tablets:

a. **Floating Lag Time:**

This is the amount of time, expressed in seconds or minutes, that it takes for the tablet to surface on the dissolving media.

b. **In vitro drug release and floating duration**:

This is computed by using stirrers (USP II devices, paddles) at 50 or 100 rpm and 37±0.20C to replicate stomach juice (pH 1.2, no pepsin). After then, the samples are regularly gathered and their drug content is examined. The floating duration—which is visibly observed—is the amount of time (in hours) that the tablets float on the surface of the dissolving solvent.

c. **Evaluation of In-vivo Gastro-Retention:**

This is achieved by measuring the dose form transition in the GIT using gamma-scintigraphy or X-ray technology. The pills are also examined for hardness, weight variance, etc.

Techniques for Creating a Floating Medication Delivery System [23–26]

- **Direct compression technique:**

This involves compressing tablets straight from their powder form without changing the physical makeup of the material. The most common carriers are tricalcium phosphate, dicalcium trihydrate phosphate, etc.

- **Effervescent Technique:**

The floating chamber of the medication delivery system will be filled with inert gas (CO2) through an effervescent reaction between organic acid (citric acid) and bicarbonate salts.

- **Wet granulation technique:**

this method entails milling, drying, or massaging powder in water. Instead of compacting the powders, wet granulation forms the granules by glueing them together using an adhesive.

- **Ionotropic Gelation Technique:**

In order to create instantaneous microparticles, the anionic polysaccharide sodium alginate, the main polymer derived from nature, was gelled using oppositely charged calcium ions, or counter-ions.

- **Solvent evaporation technique:**

The liquid dispersal solvent cannot be completely removed with continuous phase ability. To

receive the hardened microspheres, the solvent evaporation from the dispersal surface occurs.

- **Spray Drying Technique:**

This method entails distributing the core layer into the liquid coating content and spraying the core coating mixture into the surrounding air to solidify the coating through a quick evaporation process that solubilizes the coating material.

- **Melt Solidification Technique:**

In this technique, the molten mass is emulsified in the aqueous phase and then cooled to solidify. This approach employs lipids, waxes, polyethylene glycol, and other carriers.

- **Melt Granulation Technique:**

This technique uses a meltable binder to agglomerate pharmaceutical powders without the use of organic solvents or water.

Assessment of Floating Medication Delivery Devices [27–30]

Bulk density is the product of the powder's bulk volume (Vo) and total mass (m).

Db = m / Vo The ratio of the powder's total mass (m) to its tapped volume (Vi) is known as the "tapped density."

Dt equals m/Vi.

Compressibility Index: The bulk density (ρo), tapped density (ρt), and rate of pack-down of the powder can all be used to assess the flow ability of the material. Compressibility index determined using – In this case, ρt = Tapped density g/ml and ρo = Bulk density g/ml.

Hausner's Ratio:

This is calculated by taking the Tapped density and dividing it by the Bulk density using the formula below.

Tapped density / Bulk density equals Hausner's ratio.

Specification for Carr's index and Hausner's ratio.

Sl. No.	Flowability	Carr's index (%)	Hausner's ratio
1	Excellent	0-10	1.00-1.11
2	Good	10-15	1.12-1.18
3	Fair	16-20	1.19-1.25
4	Possible	21-25	1.26-1.34
5	Poor	26-31	1.35-1.45

Angle of Repose:

This metric allows one to quantify the frictional forces within a loose powder or grains. This is the greatest angle that can exist between a granule or powder pile's surface and the horizontal plane. Granules are permitted to pass through a funnel that is mounted to a stand at a predetermined height (h).

The height and radius of the granule heap created were then used to calculate the angle of repose.

$$\tan\theta = (h/r)$$

$\theta = \tan^{-1}(h/r)$

θ represents the angle of repose.

h = the heap's height

r = radius of the heap

Below illustrates the connection between angle of repose and particle flow.

Angle of repose	Powder flow
<25	Excellent
25-30	Good
30-40	Passable
>40	Very poor

Tablet Dimensions:

A calibrated Vernier Calliper was used to measure the tablet's thickness and diameter. Each formulation's three tablets were chosen at random, and each tablet's thickness was assessed independently.

Hardness:

A tablet's ability to withstand mechanical shocks during handling is indicated by its hardness. Using

a Monsanto hardness tester, the tablets' hardness was assessed. It was stated as kg/cm^2. The pills' hardness was determined after three were chosen at random.

Friability test:

The Roche Friabilator was used to assess the friability of tablets. It was stated as a percentage (%). First, ten tablets were weighed (W) and then placed in the friabilator. The friabilator was run for four minutes at 25 rpm or up to 100 rotations. Once more, the tablets have been weighed (Wo). Next, the percentage friability was determined using formula–

%F = 100 (1-Wo/W)

Less than 1% of tablets were deemed to have desirable friability.

Tablet Density:

For floating tablets, tablet density was a great criterion. When the tablet's density was significantly lower than that of stomach fluid, it was most successful at floating (1.004). The density was ascertained by applying the subsequent formula.

V is equal to ⌀r2h.

D is equal to m/v.

where v is the tablet's volume (cc).

Tablet radius (cm) = r

h = tablet crown thickness (g/cc)

m = tablet mass

Weight Variation Test:

To check for weight variation, ten pills were randomly chosen from each batch and weighed individually. According to US Pharmacopoeia, a small amount of variance in a tablet's weight was permitted.

Weight variation percentage deviation

Average weight of a tablet	Percent deviation
130 mg or less	10
>130mg and <324mg	7.5
324mg or more	5

Calculating the buoyancy lag time:

The buoyancy lag is the amount of time it takes for a tablet to rise to the surface and begin to float. The buoyancy of tablets was investigated in 900 milliliters of gastric-simulation fluid at 37±0.5ºC. A stop watch was used to measure the buoyancy lag time, and ocular observation of the total floating duration was made.

Floating time:

Using 900ml of 0.1N HCl and a USP dissolution apparatus-II operating at 50 rpm, the temperature was maintained at 37±0.5ºC for the duration of the investigation. The amount of time the tablet floats in the dissolving medium—including the floating lag time, or the amount of time it takes for the tablet to rise to the surface—is known as the floating duration, or floating time. This can be observed visually.

Swelling Index:

For the floating sustained release layer tablets, a swelling investigation was conducted. After precisely weighing the tablets, they were put in USP dissolution equipment II, which had 900ml of 0.1N HCl kept at 37±2ºC, and let to swell until they reached a consistent weight. The tablets were taken out, wiped with filter paper, and weight variations were recorded. Three duplicates of the experiments were carried out. Using the formula, the degree of swelling (Swelling index) was then calculated. where Wo is the tablet's starting weight and Wg is the tablet's weight when the medium has reached equilibrium swelling. In-vitro dissolving studies: USP dissolving Testing Apparatus II (Paddle type) was used to measure the release rate of floating tablets. 900 millilitres of 0.1N HCL were used, and the test for dissolution was run at 37 ± 0.5°C. For a duration of 12 hours, a sample (5 millilitres) of the solution was extracted from the dissolution device every hour. The samples were then replaced with brand-new dissolution medium. After passing the samples through Whatman's filter paper, the absorbance of the solutions was calculated.

CONCLUSION:

Gastro retentive floating tablet maintain consistent therapeutics levels in the stomach, thereby enhancing its bio availability and maximizing the utilization of the administered dose. This system providing sustained drug release, ensuring prolonged gastric retention and potentially improving the clinical efficacy in the treatment of gastric infections. Based on the different literature survey we concluded that GRDDS has a specific scope in pharmaceutical filed, the market of GRDDS product would be vast will more patient compliance.

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