Review Article

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Review on gastro - retentive drug delivery system and advancements in controlled release

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ABSTRACT

The novel approaches of the Gastro - Retentive drug Delivery system improve the drug Bio - availability and patient compliance by increasing the Gastric residence time and controlling the drug release. Various GRDDS approaches can be utilized to retain the dosage forms in the stomach and to release the drug slowly for an extended period of time. GRDDS can be used to prolong the residence time of delivery system in the stomach. This results in targeting of drug release at a specific site for the systemic or local effects. Various drug which are unstable in alkaline PH, soluble in acidic PH, having narrow absorption window, site of action specific to stomach can be developed by using this technique. Gastro - retentive drug delivery system can be used to overcome challenges associated with conventional oral dosage forms and to release the drug at a specific absorption site to improve the Bioavailability of the drug. Gastro retentive dosage forms greatly improves the pharmacotherapy of stomach by releasing the locally and thus results into high concentration of drug at the Gastro mucosa which can be sustained over a longer duration of time. The challenges include fast gastric emptying of the dosage form which result in poor Bio - availability of drug. The purpose of this paper is to briefly describe the approaches of gastro - retentive drug delivery system such as high density, low density (Floating system), mu co adhesive, Expandable, magnetic system and raft forming system.

Keywords: Gastro retention, GIT's Physiology, Gastric residence time, Floating system, muco - adhesive system.

INTRODUCTION

Generally the drugs which get easily absorbed in GIT exhibit short half - lives and are eliminated quickly from systemic circulation and to achieve a suitable therapeutic activity of such drugs, it is necessary to give the dose frequently. To overcome these side effects, Gastro retentive drug delivery system were developed. Gastro retentive delivery is one of the site specific delivery of the drugs at stomach. It is obtained by retaining dosage form into stomach and drug is being released at sustained manner to specific site either in stomach or intestine. These systems were designed to prolong the residence time of a drug in the GIT. Gastric retention can be done by using mu co adhesive, size-based and altered density systems. GRDDS continuously release the drug for a prolonged period before it reaches its site of absorption and thereby insures optimal bio - availability of drugs having a low absorption window. Oral route of drug administration is the most convenient and commonly used method of drug delivery. However, this route has several physiological problems. Including an unpredictable gastric emptying rate that varies from person to person, a brief gastrointestinal transit time (80-12h), and the existence of an absorption window in the upper small intestine for several drugs. These difficulties have prompted researchers to design a drug delivery system which can stay in the stomach for prolonged and predictable period. Attempts are being

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made to develop a drug delivery system which can provide therapeutically effective plasma drug concentration for a longer period, thereby reducing the dosing frequency and minimizing fluctuation in plasma drug concentration at steady state by delivering the drug in a controlled and reproducible manner.One novel approach in this area is GRDDSs (gastro retentive drug delivery system). Dosage forms that can be retained in the stomach are called GRDDs. GRDDSs can improve the controlled delivery of drugs that have an absorption window by continuously releasing the drug for a prolonged period of time before it reaches its absorption site. Prolonging the gastric retention of the drugs is sometimes desirable for achieving therapeutic benefits of drug that are absorbed from the proximal part of the GIT (gastro intestinal tract) or those are less soluble in or are degraded by alkaline pH or they encounter at the lower part of the GIT. GRDDS are beneficial for such drugs by improving their

- Bioavailability
- Therapeutics efficiency and
- Possible reduction of the dose.
- Apart from these advantages, these systems offer various pharmacokinetic advantages like, maintenance of constant therapeutic levels over a prolonged period and thus reduction in fluctuation in the therapeutic levels.

Gastro retentive drug delivery system (GRDDS) has proven to be effective in systemic actions as well as in local action to treat Gastric or duodenal ulcers. GRDDS have two main problems such as short Gastric retention time (GRT) in stomach and unpredictable short Gastric emptying time (GET) which may lead to insufficient drug release from dosage form in the absorption area which results in low efficacy of administered drug. To develop a site - specific oral controlled release drug delivery system, it is beneficial to improve a GRT of drug formulation since the last few decades, different types of GRDDS approaches have been designed and developed. It includes high density or sinking system which can be retained in the basal part of the stomach. Low density or floating system that continue to float on gastric fluid. Mucoadhesive system causes adhesion to the mucosa of the stomach, un foldable, extendible or swellable system. That restrict the emptying of delivery system out from the pyloric sphincter of the stomach, superporous hydrogel systems, magnetic system etc.

PHYSIOLOGY OF THE STOMACH

The Gastrointestinal tract is essentially a tube about nine meters long that runs through the middle of the body from the mouth to the anus and includes the throat (pharynx), esophagus, stomach, small intestine (consisting of the duodenum, jejunum and ileum) and large intestine (consisting of the cecum, appendix, colon and rectum). The wall of the gastrointestinal tract has the same general structure throughout most of its length from the esophagus to the anus, with some local variations for each region. The stomach is an organ with a capacity for storage and mixing. The antrum region is responsible for the mixing and grinding of gastric contents. The interdigestive motility pattern is commonly called the 'migrating motor complex' ('MMC') and is organized in cycles of activity and quiescence. Each cycle lasts 90–120 minutes and consists of four phases. The concentration of the hormone motilin in the blood controls the duration of the phases. In the interdigestive or fasted state, an MMC wave migrates from the stomach down the GI tract every 90–120 minutes. A full cycle consists of four phases, beginning in the lower esophageal sphincter/gastric pacemaker, propagating over the whole stomach, the duodenum and jejunum, and finishing at the ileum. Phase III is termed the 'housekeeper wave' as the powerful contractions in this phase tend to empty the Stomach of its fasting contents and indigestible debris. The administration and subsequent ingestion of food rapidly interrupts the MMC cycle, and the digestive phase is allowed to take place. The upper part of the stomach stores the ingested food initially, where it is compressed gradually by the phasic contractions. The digestive or fed state is observed in response to meal ingestion. It resembles the fasting Phase II and is not cyclical, but continuous, provided that the food remains in the stomach. Large objects are retained by the stomach during the fed pattern but are allowed to pass during Phase III of the interdigestive MMC. It is thought that the sieving efficiency (i.e. the ability of the stomach to grind the food into smaller size) of the stomach is enhanced by the fed pattern or by the presence of food (Fig. 1 and 2).

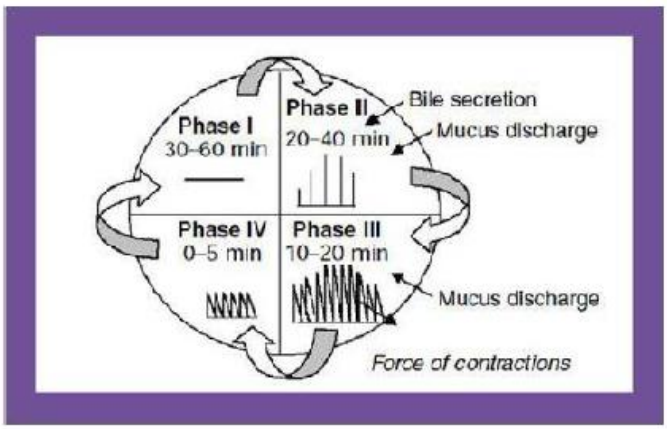


Figure: 1 Phase of gastric cycle

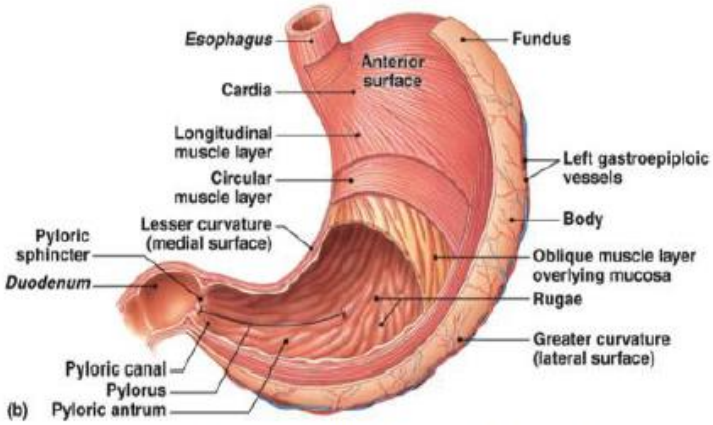
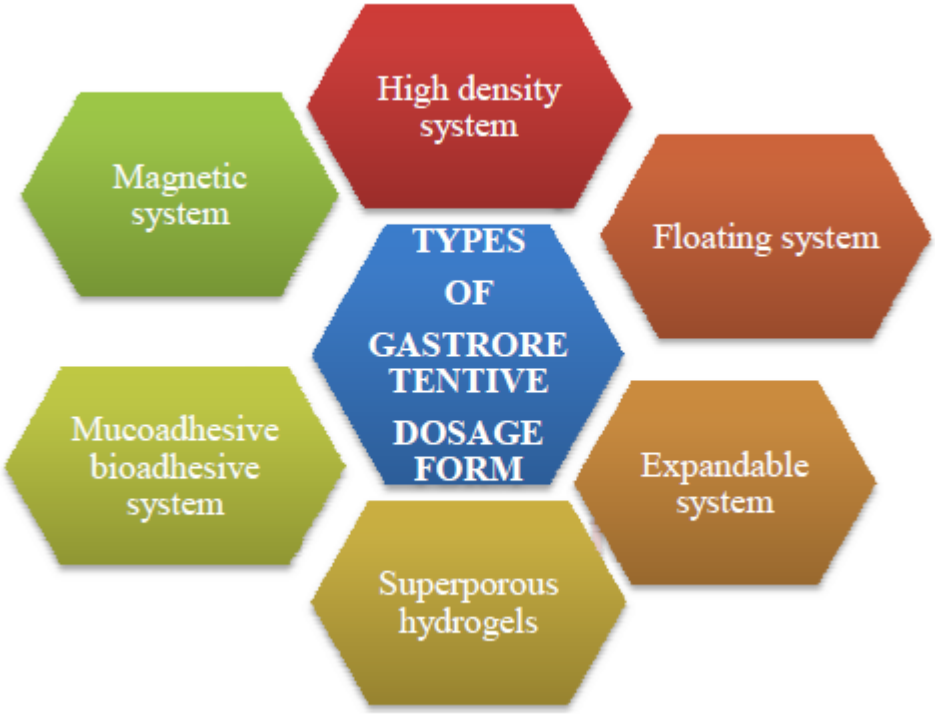


Figure: 2 physiology of stomach

GASTRO RETENTIVE TECHNOLOGIES



HIGH DENSITY SYSTEM

This approach involves formulation of dosage forms with density that must exceed density of normal stomach content (1.004g/ml). These formulations are prepared by coating drug on a heavy core or mixed with heavy inert material such as iron powder, zinc oxide, titanium dioxide, barium sulphate. The resultant pellets can be coated with diffusion ontrolled Membrane. These systems have some drawbacks. like they are technically difficult to manufacture with a large amount of drug because the dry material interacts within the gastric fluid to release its drug contents. One other problem is that no such system is available in the market.

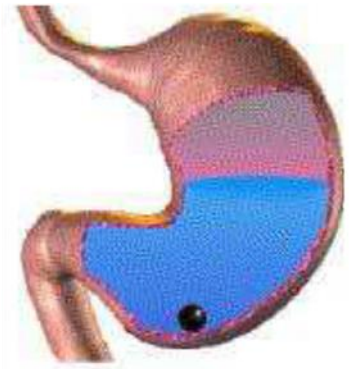


Fig. 3: High density system

FLOATING OR LOW DENSITY SYSTEM

By virtue of their low densities, FDDS remain afloat above the gastric contents for prolonged periods of time and provide continuous release of the drug. These systems in particular have been extensively studied because they do not adversely affect the motility of the GIT. Their dominance over the other types of GRRDS is also evident from the large number of floating dosage forms being commercialized and marketed world-wide.

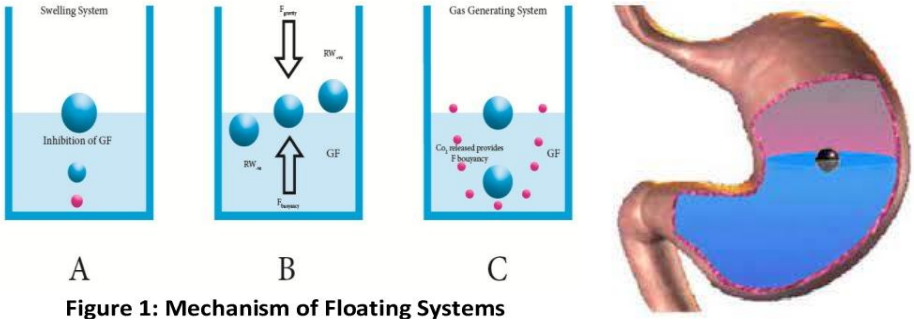
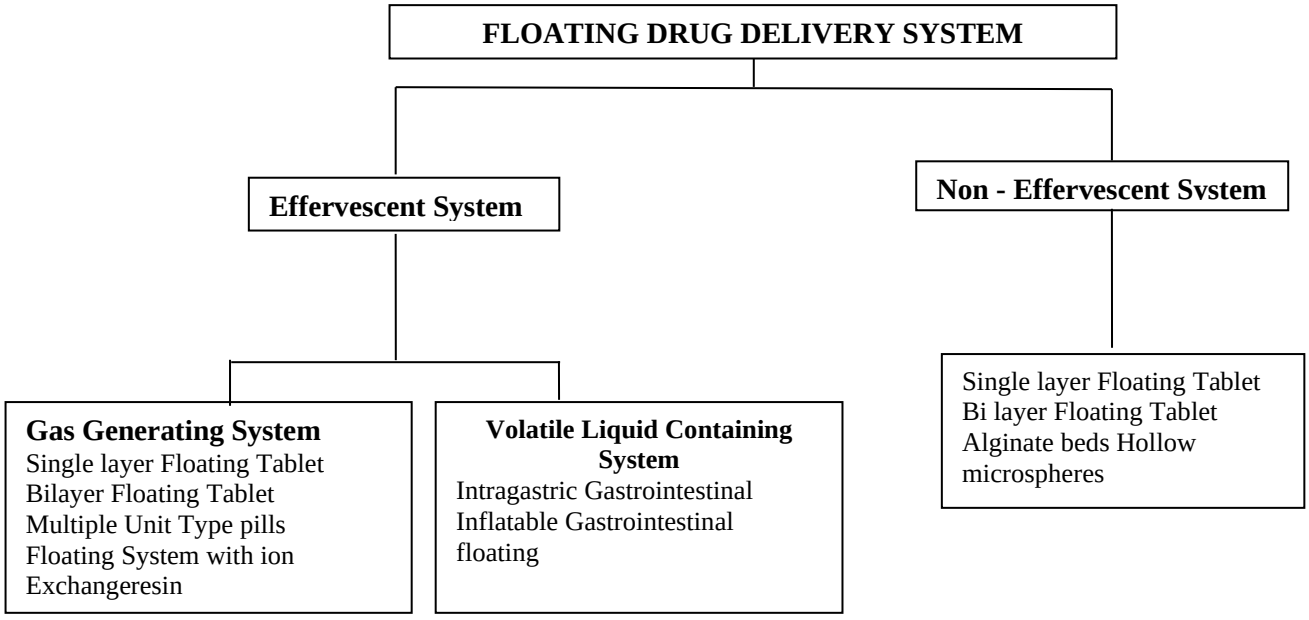


Figure 1: Mechanism of Floating Systems



Classification of Floating System

EFFERVESCENT SYSTEM

Effervescent systems include use of gas generating agents, carbonates (e.g. Sodium bicarbonate) and other organic acid (e.g. citric acid and tartaric acid) present in the formulation to produce carbon dioxide (CO_2) gas, thus reducing the density of system and making it float on the gastric fluid. An alternative is the incorporation of matrix containing portion of liquid, which produce gas that evaporate at body temperature[20].These effervescent systems further classified into two types.

1) Gas generating systems
2) Volatile liquid/vacuum systems

GAS GENERATING SYSTEMS

These buoyant delivery systems utilize effervescent reactions between Carbonate/bicarbonate salts and citric/tartaric acid to liberate CO2, which gets entrapped in the jellified hydrocolloid layer of the systems thus decreasing its specific gravity and making it to float over gastric content.

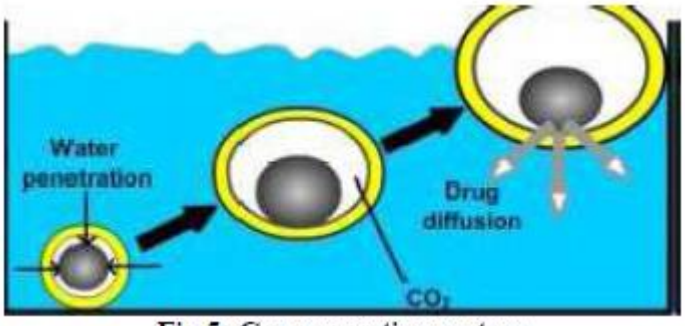


Fig.5: Gas generating system

SINGLE LAYER FLOATING TABLETS OR HYDRO DYNAMICALLY BALANCED SYSTEM (HBS)

These are formulated by intimately mixing the CO2 generating agents and the drug within the matrix tablet. These have a bulk density lower than gastric fluids and therefore remain floating in the stomach unflattering the gastric emptying rate for a prolonged period. The drug is slowly released at a desired rate from the floating system and after the complete release the residual system is expelled from the stomach. This leads to an increase in the grt and a better control over fluctuation in plasma drug concentration.

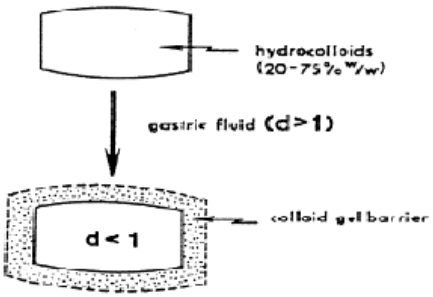


Fig. 6: Single layer floating tablet

BILAYER FLOATING TABLETS

These are also compressed tablet as shown in Fig and containing two layer i.e.(1)Immediate release layer (2) Sustained release layer.

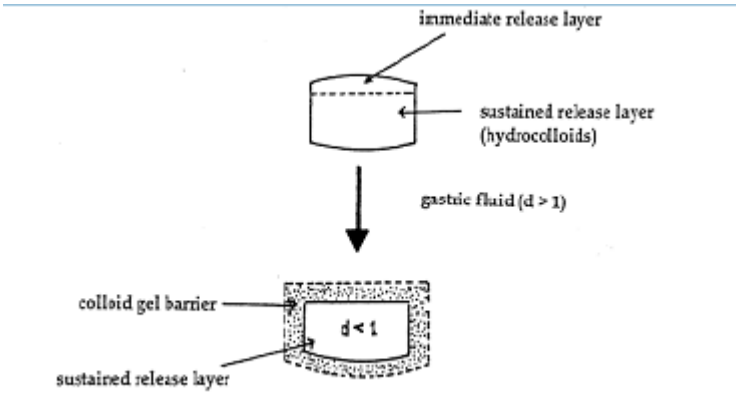


Fig. 7: Bilayer floating tablet

MULTIPLE UNIT TYPE FLOATING PILLS

These systems consist of sustained release pills as 'seeds' surrounded by double layers. The inner layer consists of effervescent agents while the outer layer is of swellable membrane layer. When the system is immersed in dissolution medium at body temperature, it sinks at once and then forms swollen pills like balloons, which float as they have lower density. This lower density is due to generation and entrapment of CO2 within the systems

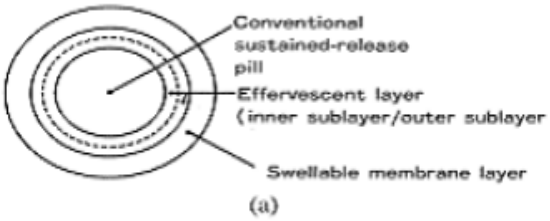


Fig.8: Multiple unit floating tablet

ION EXCHANGE RESIN

Ion-exchange resins, a multiple-unit type of oral floating dosage system has been prepared to prolong gastric emptying time of dosage form. The system is composed of beads ofdrug-resin complex, which are loaded with bicarbonate ions and coated with a hydrophobic polymer. The system is so designed that when the beads reach the stomach, chloride ions are exchanged with bicarbonate and drug ions. The generated CO2 is entrapped in the polymeric coated resins and causes the beads to float.

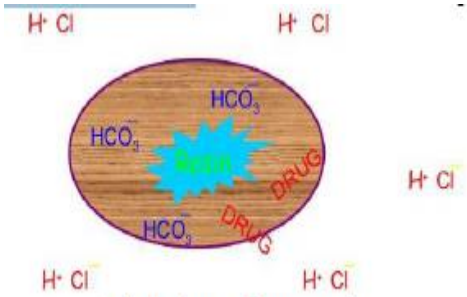


Fig.9: Ion exchange resin

VOLATILE LIQUID CONTAINING SYSTEM

The GRT of a drug delivery system can be sustained by incorporating an inflatable chamber, which contains a liquid e.g. ether, cyclopentane, that gasifies at body temperature to cause the inflatation of the chamber in the stomach. The device may also consist of abioerodible plug made up of Poly vinylalcohol, Polyethylene etc. that gradually dissolves causing the inflatable chamber to release gas and collapse after a predetermined time to permit the spontaneous ejection of the inflatable systems from the stomach.

INTRAGASTRIC FLOATING GASTROINTESTINAL DRUG DELIVERY SYSTEM

These systems can be made to float in the stomach because of floatation chamber, which may be a vacuum or filled with air or a harmless gas, while drug reservoir is encapsulated inside a microporous compartment

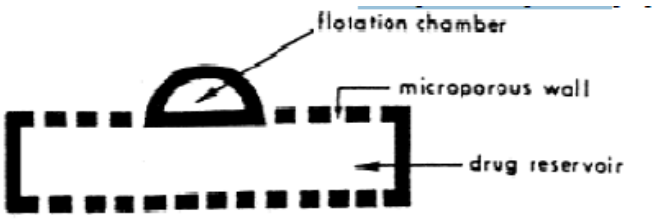


Fig.10: Intragastric floating drug delivery device

INFLATABLE GASTROINTESTINAL DELIVERY SYSTEMS

In these systems an inflatable chamber is incorporated, which contains liquid ether that gasifies at body temperature to cause the chamber to inflate in the stomach. These systems are fabricated by loading the inflatable chamber with a drug reservoir, which can be a drug, impregnated polymeric matrix, then encapsulated in a gelatin capsule. After oral

administration, the capsule dissolves to release the drug reservoir together with the inflatable chamber. The inflatable chamber automatically inflates and retains the Drug Reservoir into the gastric fluid**.**

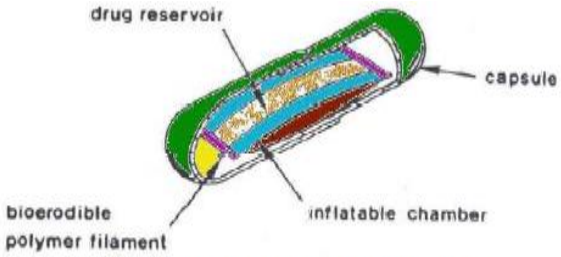


Fig.11: Inflatable Gastrointestinal Delivery Systems

NON-EFFERVESCENT FDDS

The Non-effervescent FDDS is based on mechanism of swelling of polymer or bio adhesion to mucosal layer in GI tract. The most commonly used excipients in non-effervescent FDDS are gel forming or highly swellable cellulose type hydrocolloids, hydrophilic gums, polysaccharides and matrix forming materials such as polycarbonate, polyacrylate, polymethacrylate, polystyrene as well as bioadhesive polymers such as Chitosan.[28,29]The various type of this systems are as follows:

SINGLE LAYER FLOATING TABLETS

They are formulated by intimate mixing of drug with gelforming hydrocolloid, which swells in contact with gastric
fluid and maintain bulk density of less than unity. The air trapped by the swollen polymer confers buoyancy to these dosage forms.

BILAYER FLOATING TABLETS

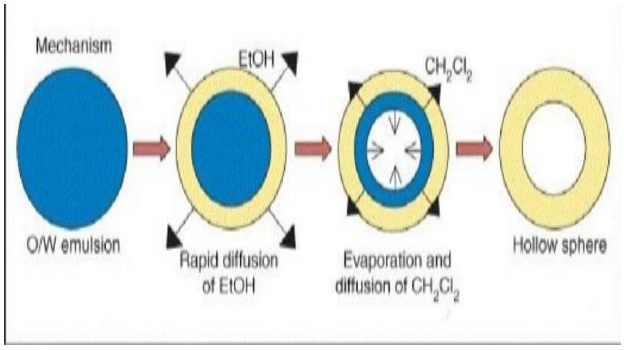
A bilayer tablet contain two layer immediate release layer which release initial dose from system while the another sustained release layer absorbs gastric fluid, forming an impermeable colloidal gel barrier on its surface, and maintain a bulk density of less than unity and thereby it remains buoyant in the stomach.

ALGINATE BEADS

Multi-unit floating dosage forms have been developed from freeze dried calcium alginate. Spherical beads of approximately 2.5 mm in diameter can be prepared by dropping sodium alginate solution into aqueous solution of calcium chloride, causing the precipitation of calcium alginate. The beads are then separated, snap-frozen in liquid nitrogen, and freeze-dried at -40ºC for 24 hours, leading to the formation of a porous system, which can maintain a floating force for over 12 hours. These floating beads gave a prolonged residence time of more than 5.5 hours.

HOLLOW MICROSPHERES (MICROBALLOONS)

Hollow microspheres loaded with drug in theirouter polymer shelf were prepared by a novel emulsion solvent diffusion method22. The ethanol/dichloromethane solution of the drug and an enteric acrylic polymer was poured into anagitated solution of Poly Vinyl Alcohol (PVA) that was thermally controlled at 40ºC. The gas phase is generated in the dispersed polymer droplet by the evaporation of dichloromethane formed and internal cavity in the microsphere of the polymer with drug. The micro balloon floated continuously over the surface of an acidic dissolution media containing surfactant for more than 12.



MUCOADHESIVE SYSTEMS

Mucoadhesive drug delivery systems contain a mucoadhesive polymer that adheres to the gastricmucosal surface and prolong its gastric retention in the git. The capability to adhere to the mucus gel layermakes mucoadhesive polymers very useful exicipientsin the GRRDS. These polymers can be natural such assodium alginate, gelatin, guar gum etc.semisynthetic polymers such as HPMC, carbopol, sodium carboxymethyl cellulose [33]the adhesion of polymers withmucous membrane may be mediated by hydration, bonding, or receptor mediated. In

hydration mediated adhesion, the hydrophilic polymer become sticky and mucoadhesive upon hydration. Bonding mediated involves mechanical or chemical bonding. Chemical bonds may involve ionic or covalent bonds or vander Waal forces between the polymer molecule and the mucous membrane. Receptor mediated adhesion takes place between certain polymers and specific receptors expressed on gastric cells. The polymers can be cationic or anionic or neutral.

HYDRATION – MEDIATED ADHESION

Certain hydrophilic polymers have the tendency to imbibe large amount of water and become sticky, thereby acquiring bioadhesive properties. The prolonged gastroretention of the bio/muco-adhesive delivery system is further controlled by the dissolution rate of the polymer.

BONDING –MEDIATED ADHESION

Adhesion of polymers to mucus/epithelial cell surface involves varying bonding mechanism. Physical or mechanical bonds can result from deposition and inclusion of the adhesive material in the crevices of the mucusa. Secondary chemical bonds, contributing to bioadhesive properties, consist of dispersive intractions (i.e. van der Walls intractions) and stronger specific intraction, which include on the cell surface. The receptor mediated hydrogen bonds. The hydrophilic functional groups responsible for forming hydrogen bonds are the hydroxyl (--OH) and the carboxylic groups (--COOH)

RECEPTOR -MEDIATED ADHESION

Certain polymers have the ability to bind to specific receptor sites events serves as a potential approach in bio/muco-adhesion, hence enhancing the gastric retention of dosage forms. Certain plant lectins, like tomato lectins, interact specifically with the sugar groups present in mucus or on the glycocalyx.

SWELLING SYSTEM

These are the dosage forms, which after swallowing swells to such an extent that their exit from the pylorus is prevented, as a result the dosage form is retained in the stomach for a prolonged period of time. These systems are called as plug – type system as they have the tendency to remain lodged at the pyloric sphincter. Controlled and sustainedrelease may be achieved by selection of proper molecular weight polymer, and swelling of the polymers retard the release [39]. On coming in contact with gastric fluid the polymer imbibes water and swells. The extensive swelling of these polymers is due to the presence of physical chemical cross links in the hydrophilic polymer network. These cross link sprevents the dissolution of the polymer and hence maintain the physical integrity of the dosage form. In the dissolution media the membrane detached from the core and swelled to forma balloon that kept the unit floating. the size of the units increased by three to six folds, thus the floating ability as well as the increased dimension offered the system gastro retentive property.

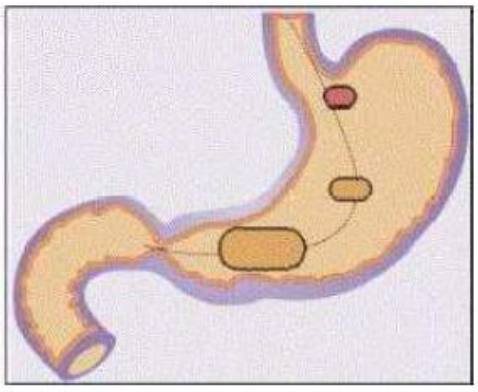


Fig.14: Swelling system

SUPER POROUS HYDRO GELS

These are swellable systems that differ from conventional types. Absorption of water by conventional hydro gel is very slow process and several hours may be required to reach the equilibrium states [41] during which the premature evacuation of the dosage form may occur. Super porous hydro gel have a pore size >100µm which swell to equilibrium size with in a minutes, due to rapid intake of water by capillary wetting through inter connected open pores. They swell to a larger size and have sufficient mechanical strength to withstand the pressure by gastric contraction. This is achieved by co formulation of a hydrophilic particulate material, Ac-Di-Sol

MAGNETIC SYSTEM

This system is based on the simple idea that the dosage form contains a small internal magnet, and a magnet placed on the abdomen over the position of the stomach. Using a extracorporeal magnet, gastric residence time of the dosage form can be enhanced for a prolonged period of time.

FACTORS INFLUENCING GASTRIC RESIDENCE TIME

- Density of dosage form: Dosage forms having density lower than that of gastric fluids experience floating behavior and greater gastric residence time.

- Size of dosage form: In most cases larger the size greater the gastric residence time because larger size will not allow dosage form to quickly pass through pyloric spincter to intestine.
- Food intake and nature of food: Usually presence of food in stomach increases the GRT of the dosage form and increases drug absorption by allowing it to stay at absorption site for longer time.
- Affect of age, gender, posture and disease state: Elderly persons and females has slow gastric emptying rate. It was found that gastric emptying in women is slower than in men regardless of height, weight, body surface area.
- When individual rests on left side floating of dosage form will be towards pyloric antrum. If rests on right side it will be in opposite direction.
- Shape of dosage form: Tetrahedrons (each leg 2 cm long), rings (36 cm diameter) exhibited nearly 100% retention at 24 hrs. Whereas on other hand cloverleaves (2.2-3.3 cms) exhibit (40- 67%) retention. Ideal drug characteristics for gastrointestinal drug delivery system.
- Drug acting locally in the stomach antacids and drug for H.Pylori via Misoprostol.
- Drugs that are primary absorbed in the stomach and upper part of GIT. E.g. Amoxicillin and calcium supplement, Cinnarazine, Chlordiazopoxide.
- Drug that is poorly soluble at alkaline pH e.g. Furosemide, Diazepam , Verapamil HCl
- Drug which are absorbed rapidly from GI. E.g. Riboflavin, PABA, Cyclosporine, Methotrexate, Levodopa, Captopril, Ranitidine HCl, Metronidazole, Metformin HCl.
- Drug that degrade or unstable in colon. E.g. Captopril, ranitidine HCl, metronidazole , metformin HCl.
- Drug that disturb normal colonic microbes, e.g. Amoxicillin Trihydrate, Antibiotic against Helicobacter Pylori.

ADVANTAGES OF GASTRORETENTIVE DRUG DELIVERY SYSTEMS

Enhanced bioavailability

The bioavailability of riboflavin CR-GRDF is significantly enhanced in comparison to the administration of non-GRDF CR polymeric formulations. There are several different processes, related to absorption and transit of the drug in the gastrointestinal tract, that act concomitantly to influence the magnitude of drug absorption

Enhanced first-pass biotransformation

In a similar fashion to the increased efficacy of active transporters exhibiting capacity limited activity, the pre-systemic metabolism of the tested compound may be considerably increased when the drug is presented to the metabolic enzymes (cytochrome P450, in particular CYP3A4) in a sustained manner, rather than by a bolus input23.

Sustained drug delivery/reduced

frequency of dosing For drugs with relatively short biological halflife, sustained and slow input from CR-GRDF may result in a flip-flop pharmacokinetics and enable reduced dosing frequency. This feature is associated with improved patient compliance, and thereby improves therapy.

Targeted therapy for local ailments in the upper GIT

The prolonged and sustained administration of the drug from GRDF to the stomach may be advantageous for local therapy in the stomach and small intestine. By this mode of administration, therapeutic drug concentrations may be attained locally while systemic concentrations, following drug absorption and distribution, are minimal.

Reduced fluctuations of drug concentration

Continuous input of the drug following CRGRDF administration produces blood drug concentrations within a narrower range compared to the immediate release dosage forms. Thus, fluctuations in drug effects are minimized and concentration dependent adverse effects that are associated with peak concentrations can be prevented. This feature is of special importance for drugs with a narrow therapeutic index24.

Minimization of fluctuations in drug concentration

It makes it possible to obtain certain selectivity in the elicited pharmacological effect of drugs that activate different types of receptors at different concentrations.

Reduced counter-activity of the body

In many cases, the pharmacological response which intervenes with the natural physiologic processes provokes a rebound activity of the body that minimizes drug activity. Slow input of the drug into the body was shown to minimize the counter activity leading to higher drug efficiency.

Extended time over critical (effective) concentration

For certain drugs that have non-concentration dependent pharmacodynamics, such as etalactam antibiotics, the clinical response is not associated with peak concentration, but rather with the duration of time over a critical therapeutic concentration. The sustained mode of administration enables extension of the time over a critical concentration and thus enhances the pharmacological effects and improves the clinical outcomes.

Minimized adverse activity at the colon

Retention of the drug in the GRDF at the stomach minimizes the amount of drug that reaches the colon. Thus, undesirable activities of the drug in colon may be prevented. This pharmacodynamic aspect provides the rationale for GRDF formulation for beta-lactam antibiotics that are absorbed only from the small intestine, and whose presence in the colon leads to the development of microorganism's resistance.

Site specific drug delivery

A floating dosage form is a feasible approach especially for drugs which have limited absorption sites in upper small intestine25. The controlled, slow delivery of drug to the stomach provides sufficient local therapeutic levels and limits the systemic exposure to the drug. This reduces side effects that are caused by the drug in the blood circulation. In addition, the prolonged gastric availability from a site directed delivery system may also reduce the dosing frequency.

DISADVANTAGES OF GASTRORETENTIVE DRUG DELIVERY SYSTEMS

1. Unsuitable for drugs with limited acid solubility. E.g. Phenytoin
2. Unsuitable for drugs that are unstable in acidic environment. E.g. Erythromycin
3. Drugs that irritates or causes gastric lesions on slow release. E.g. Aspirin & NSAID's
4. Drugs that absorb selectively in colon. E.g. Corticosteroid
5. Drugs that absorb equally well through GIT. E.g. Isosorbide dinitrate, Nifidipine
6. Floating drug delivery systems require high fluid level in stomach to float and work effectively.

ADVANCEMENTS IN GASTRORETENTIVE DRUG DELIVERY SYSTEM

Dual working systems

These systems are based on the two working principles of either floating and bioadhesion or swelling and bioadhesion. FDDS are formulated to persist floating on the gastric fluid when the stomach is full after a meal. However, as the stomach empties and the tablet reaches the pylorus, the buoyancy of the dosage form may be reduced. It may be that the dosage form will then pass through the pylorus into the small intestine. Thus, the buoyancy of an FDDS in the stomach may be limited to only 3–4 h. Furthermore, floating systems do not always release the drug at the intended site. In a bioadhesive drug delivery system, it is quite likely that the system becomes dislodged from the stomach mucosa wall when the system is full and the semiliquid contents are churning around due to the effect of peristalsis. A dual working system would overcome drawbacks associated with bioadhesive, swelling, and floating systems, and would have a significant effect on improving the therapeutic effect of the drug involved.

Floating osmotic systems

A floating osmotic drug delivery system employs the principal of osmotic pressure to float on the gastric fluid. Basically these systems comprise of three parts; an osmotic core (containing drug reservoir, osmotic agents, and other excipients), a shape retaining semipermeable membrane; and an outer compression coating consisting of gas generating and gel forming agents. For delivery of drug an orifice is bored through both the outer layers. After administration when this system comes in contact with gastric fluid, initially CO2 is generated due to the presence of a gas forming agent and this generated gas entraps within the bed of swelled gel, thus the system became buoyant due to diminished density. Delivery of drug then totally depends upon the osmotic pressure generated inside the osmotic core.

Floating-pulsatile systems

Pulsatile drug delivery systems release the drug rapidly and completely after certain lag times. However, an uncertainty is always associated with such systems, they may expel out from the body without releasing drug content due to the presence of lag time. Floating pulsatile systems develop to overcome this drawback and have gained increasing interest during recent years for a number of drug therapies.

MARKETED PRODUCTS OF GASTRORETENTIVE DRUG DELIVERY SYSTEM

BRAND NAME	ACTIVE INGREDIENTS
Cifran OD®	Ciprofloxacin
Madopar®	L-Dopa and Benserazide
Valrelease®	Diazepam
Topalkan®	Aluminium-magnesium antacid
Almagate FlatCoat	® Aluminium-magnesium antacid
Liquid Gavision®	Aluminium hydroxide
Conviron®	Ferrous sulfate
cytotec®	Misoprostal

CONCLUSION

Development of an efficient gastro retentive dosage form for stomach specific drug delivery is an actual challenge. Thus to produce the preferred Gastro retention several methods have been used out of which, the floating drug delivery system has emerged as the best promising method. These systems provide the benefit of better absorption of drugs that are absorbed from upper part of stomach. Local action of drug is increased as the system rests in stomach for longer time. This leads to less frequents dosing and enhanced efficiency of the treatment. Good stability and better drug release as compared to other conventional dosage forms make such system more reliable. Drug absorption in GIT is a highly variable procedure and prolonging GI retention of the dosage form prolongs the time of drug absorption. Floating drug delivery system promises to be a potential approach for gastric retention. Though there are number of complications to be worked out to achieve extended GI retention, many Companies are focusing toward commercializing this method. Based on the literature survey it can be concluded that Gastro retentive drug delivery systems can improve the Bio - availability of drugs that exhibit site specific absorption. It also has great significance to increase the therapeutic efficacy of drugs. In future it can be easily assumed that GRDD systems will become more popular in terms of delivering drug to the systemic circulation with improving efficiency of various types of pharmacotherapy's.

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