RESEARCH ARTICLE

Formulation and Evaluation of Gastro Retentive Floating Tablet of Cetirizine Hydrochloride using Linseed Mucilageas Polymer

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ABSTRACT

This study's objectives were to create and assess gastric-floating controlled release tablets employing flaxseed mucilage as polymer. Linseed mucilage was isolated from *Linum usitatissum* seeds. Compatibility studies were performed on drug and other excipients. This study employed individual and mixed polymers to manufacture floating CH tablets. The polymers HPMC, MCC, and linseed mucilage were utilized in various ratios. Five distinct formulae were created (F1-F5 by powder a direct compression method. Formulations was tested for various parameters including *in-vitro* drug release and floating ability. The findings of all evaluation parameters are substantial. With an 8-hour floating time and a medicine release rate of 98.4% at end of the 24 hours, the formulation (F3), including hydroxyl propylmethyl cellulose and Linseed mucilage was shown to be the best.

The current study focuses on the formulation of floating tablets using a natural polymer as a binder (Linseed mucilage). However, *in-vivo* experiments are still needed to establish the efficacy of the manufactured CH floating tablets.

Keywords: Gastric floating tablet, Linseed mucilage, Direct compression, *In-vitro* drug release.

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INTRODUCTION

The most common form of drug delivery is through the mouth. Due to benefits including patient preference, non-invasiveness, and ease of medication delivery, it is the method of choice. An oral administration accounts for over 60% of all existing small pharmaceutical products on the market. Despite these benefits, developing oral formulations faces a number of obstacles, most of which can be attributable to pharmaceutical physicochemical qualities such as poor aqueous solubility and membrane permeability.[1] Most of oral dosage forms have a number of physiological constraints, including irregular gastrointestinal transit due to varying emptying of the stomach, which results in non-uniform absorption patterns, partial release of drugs, and a shorter stay in the stomach.[2] Natural polysaccharides are now being thoroughly researched as release moderators in controlled-release dosage forms Because of their biodegradability, good biocompatibility, adequate safety background, and manufacture from renewable resources. Polysaccharides can also be easily changed using physical or chemical techniques to meet specific requirements.[3]

CH is an antihistamine of the second generation. In allergic rhinitis and persistent spontaneous urticaria, it is clinically effective. CH reduces symptom severity and improves the quality of life. CH can only be used once per day because of its fast onset of action and substantial half-life. It's removed from the body through the kidneys. Its use is efficient and well tolerated despite the most frequent side effects, minor psychomotor impairment and dry mouth, both of which are dose-dependent. CH has anti-inflammatory and anti-allergic characteristics that may be useful in clinical settings.[4,5] Gastroretentive drug delivery systems (GRDDS) are a new way to deliver oral controlled-release medications. These systems can stay in the stomach for long enough for a formulation to release the active medication into the gastric juices.[6] Using flaxseed mucilage as a polymer, this study aimed to develop and evaluate gastric-floating controlled-release tablets.[7]

MATERIAL AND METHODS

Materials

CH was provided as a gift sample from Wockhardt Pharmaceuticals, Aurangabad, MS, India. HPMC K-4, HPMC K-15 obtained from a local market from Colorcon Asia Pvt. Ltd., Goa, India, and Linseed mucilage. All other chemicals and solvents were of analytical grade.

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Methods

Isolation of mucilage

500 gm of *Linum usitatissimum* Linn., sometimes known as flaxseed or linseed, were carefully washed and soaked in 500 mL of deionized water. After 24 hours, the socked seeds were heated in deionized water for 45 minutes to swell the mucilage, then allowed to stand for 1-hour for complete mucilage release into the water, after which the mixed liquid was filtered over eight folds of muslin fabric to remove the marc. Adding acetone to the filtrate precipitated the mucilage. After extraction, the crude mucilage (5%) was collected and baked in a 40°C oven until it was fully dry.[8-10]

Compatibility studies

A Shimadzu fourier transform infrared spectrophotometer was used to acquire an FTIR spectrum of pure CH, polymer and a combination of both. 4000 to 400 cm^{-1} was the scanning range employed.[11]

Formulation of CH floating tablet

Using a direct compression technique, CH floating tablets were created using excipients and polymers to ensure the medication was consistently released after administration. Excipients were accurately weighed and gradually blended in a mortar squishing continuously to produce a homogenous mixture. The homogeneous powder was then sieved 40 times, with the powder remaining on sieve number 100. Magnesium stearate and talc were used to lubricate the powder. The powder was then compacted straight into tablets on a tablet punching machine.[12]

Evaluation of CH Floating Tablet

Weight variation

Compute the average weight of 20 tablets chosen at random. Only 2 of the individual weights depart more than the percentage displayed in the table below from the average.[13]

Friability

The tablets were precisely weighed and put into the Roche Friabilator, where they were subjected to spinning at 100 rpm, continuous shocks brought on by free falls inside the apparatus. The percent decrease in pill weight determined friability. It is acceptable to lose between 0.5 and 1% of total weight.[14]

Table 1: The Composition of CH floating tablets (AF1-AF5)

S. No.	Ingredients	Quantity mg/ tab				
		F1	*F2*	*F3*	*F4*	*F5*
1	CH	-	10	10	10	10
2	HPMC- K4	80	60	-	-	80
3	HPMC-K15	-	-	80	60	-
4	Linseed gum	6	10	14	18	24
5	MCC	90	96	92	88	82
6	Sodium bicarbonate	20	20	20	20	20
7	Magnesium stearate	5	5	5	5	5
8	Talc	5	5	5	5	5

Hardness

The tablets' hardness was tested using a Pfizer hardness tester that measured the force capable of breaking the symmetrically placed tablets using a twisted spring.[15]

Content uniformity

The amount within each tablet is present during the formulation process (or tablets). The prepared tablets were placed in a beaker having 100 mL 0.1N HCl.The same specimen (about 1-mL) was added dropwise to 10 mL with 0.1N HCL after 24 hours or after the medication had completely been drained, and absorbance was assessed at 210 nm with a UV spectrometer. Using the standard graph, the percentage of medicine released was calculated.[16]

Thickness

A screw gauge is used to determine the thickness of the tablet. It shows how the tablet's weight has changed over time.[17]

Floating lag time

The floating lag time is a measurement of the amount of time the tablet needs to float after being submerged in the dissolving liquid.[18]

Floating time

It's the amount of time the tablet spends floating in the dissolving media (i.e., the duration of floating).[19]

Dissolution studies

CH floating tablets were kept in 0.1N HCl (900 mL) dissolution liquid for the first two hours and operated at 37 ± 5°C and 75 rpm. The dissolving medium was then pH 6.8 phosphate buffer (900 mL). Always use freshly produced dissolving medium. After every 15, 30, 60, 120, 240, 480, 960 minutes, 5 mL of the dissolution medium was pipette out and volume was changed to 5 mL of pH 6.8 phosphate buffer or 0.1N HCl. Using a UV spectrophotometer calibrated to 231 nm, the samples were inspected (Table 1).[20]

RESULTS AND DISCUSSIONS

Compatibility Studies

The compatibility of chosen pharmaceuticals and polymers is determined using FTIR spectroscopy. The resulting

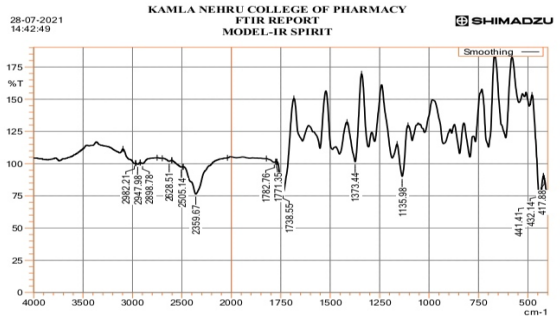

Figure 1: FTIR Spectrum of a physical mixture of CH, Linseed mucilage and excipients

Table 2: Evaluation of prepared tablet

Formulations	*Weight variation (mg)*	*Friability (%)*	*Hardness (N/mm²)*	*Thickness (mm)*	*Floating lag time (sec)*	*Floating time (Hr)*
F1	199 ± 0.12	0.25 ± 0.01	4.5 ± 0.20	3.0 ± 0.01	125 ± 2.5	8
F2	200 ± 0.10	0.30 ± 0.06	5.0 ± 0.10	2.9 ± 0.05	385 ± 4.5	9
F3	198 ± 0.33	0.45 ± 0.04	4.5 ± 0.12	3.1 ± 0.02	397 ± 5.1	6
F4	196 ± 0.32	0.55 ± 0.02	5.0 ± 0.16	3.2 ± 0.02	408 ± 3.5	6
F5	199.9 ± 0.22	0.21 ± 0.03	5.5 ± 0.09	3.0 ± 0.02	421 ± 4.3	9

(mean ± SD, n = 3)

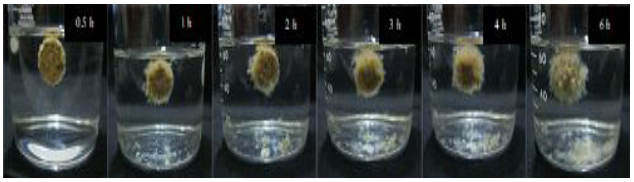

Figure 2: Photographs depicting the buoyancy of formulation AF3at pH 1.2

formulation is subjected to FTIR analysis utilising the KBr. Pellet method and a FTIR spectrophotometer, with readings ranging from 400 to 4000 cm. The excipients were shown to be compatible with CH and linseed mucilage Figure 1.

Evaluation of CH floating tablet

Weight variation

Packing the dies correctly, distributing components unevenly in the compression, and varying shear force all contribute to tablet variation. The weight variance is within 5% w/w, indicating that the compression process is adequately regulated, even when the overall weight of each batch is not kept constant, shown in Table 2.

Friability

It's a metric for how strong a tablet is. It has to do with the ability of tablets to tolerate shock and abrasion without crumbling during manufacturing, jacking, shipping, and consumer use. The % drop in tablet weight was used to measure friability. The common consensus is that a weight loss of between 0.5 and 1% or less is appropriate, shown in Table 2.

Hardness

The hardness of the tablets was determined using a Pfizer hardness tester that used a coiled spring to measure the pressure necessary to shatter the diametrically placed tablets, shown in Table 2**.**

Thickness

A screw gauge is used to determine the thickness of the tablet. Table 2 shows how the tablet's weight has changed over time.

Floating lag time

Table 2 shows the floating lag time, which is the time taken by the tablet to float on surface of the dissolution media once it has been immersed in the medium Figure 2.

Drug content

Table 3 shows the result of drug content in each formulated batch

Table 3: %drug content of prepared floating tablet

Formulations	*%drug content*
F1	98.5 ± 0.1
F2	97.2 ± 0.2
F3	98.1 ± 0.6
F4	97.5 ± 0.5
F5	98.3 ± 0.1

(mean ± SD, n=3)

Table 4: %Cumulative drug release

Time (Hr)	*%Cumulative drug release*				
Formulation	*F1*	*F2*	*F3*	*F4*	*F5*
0	0	0	0	0	0
1	20.3	12.8	16.9	17.9	13.6
2	43.5	13.2	24.3	22.7	21.6
4	59.1	28.9	32.5	36.3	33.6
8	72.6	37.1	46.3	44.3	44.8
12	80.4	46.5	59.7	56.6	62.3
16	85.2	56.9	72.2	72.6	71.3
20	95.3	62.2	86.9	82.1	76.8
24	98.4	72.2	88.3	84.1	80.3

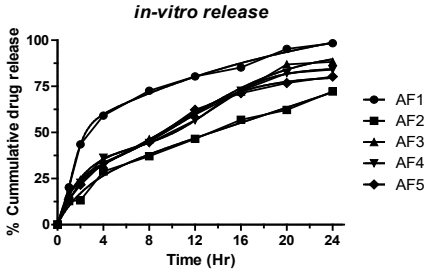

Figure 3: %Cumulative drug release

CONCLUSION

Floating drug delivery techniques improve therapeutic bioavailability by extending the time spent in the stomach. It floats in the stomach fluid because it has a lower density than a watery medium. Because of the narrow absorption window, the drug delivery devices work best in the stomach or upper small intestine.

Individual and combined polymers were used to make floating tablets of CH in this investigation. The polymers HPMC, MCC, and linseed mucilage were used in varying ratios. There were five different formulas created (F1-F5).

Direct compression was used to make the CH floating pills. The direct compression approach is straightforward and less time-consuming.

The formulation (F3) containing hydroxyl propyl methyl cellulose and linseed mucilage was shown to be the best, with an 8-hour floating time and a medication release rate of 98.4% at the conclusion of the 24 hours.

The current study focuses on formulating floating tablets using a natural polymer as a binder (Linseed mucilage). However, *in-vivo* experiments are still needed to establish the efficacy of the manufactured CH floating tablets (Table 4 and Figure 3).

REFERENCES

1. M. S. Alqahtani, M. Kazi, M. A. Alsenaidy, and M. Z. Ahmad, "Advances in Oral Drug Delivery," *Front. Pharmacol.*, vol. 12, no. February, 2021, doi: 10.3389/fphar.2021.618411.
2. S. Hua, "Advances in Oral Drug Delivery for Regional Targeting in the Gastrointestinal Tract - Influence of Physiological, Pathophysiological and Pharmaceutical Factors," *Front. Pharmacol.*, vol. 11, no. April, pp. 1–22, 2020, doi: 10.3389/fphar.2020.00524.
3. D. Suster *et al.*, "Myxoinflammatory fibroblastic sarcoma: an immunohistochemical and molecular genetic study of 73 cases," *Modern Pathology*, vol. 33, no. 12. pp. 2520–2533, 2020, doi: 10.1038/s41379-020-0580-6.
4. A. G. Corsico *et al.*, "Focus on the cetirizine use in clinical practice: A reappraisal 30 years later," *Multidiscip. Respir. Med.*, vol. 14, no. 1, pp. 1–7, 2019, doi: 10.1186/s40248-019-0203-6.
5. N. N. Vrettos, C. J. Roberts, and Z. Zhu, "Gastroretentive technologies in tandem with controlled-release strategies: A potent answer to oral drug bioavailability and patient compliance implications," *Pharmaceutics*, vol. 13, no. 10, 2021, doi: 10.3390/pharmaceutics13101591.
6. V. D. Prajapati, G. K. Jani, N. G. Moradiya, and N. P. Randeria, *Pharmaceutical applications of various natural gums, mucilages and their modified forms*, vol. 92, no. 2. Elsevier Ltd., 2013.
7. S. Alix, S. Marais, C. Morvan, and L. Lebrun, "Biocomposite materials from flax plants: Preparation and properties," *Compos. Part A Appl. Sci. Manuf.*, vol. 39, no. 12, pp. 1793–1801, 2008, doi: 10.1016/j.compositesa.2008.08.008.
8. J. Warrand *et al.*, "Structural investigations of the neutral polysaccharide of Linum usitatissimum L. seeds mucilage," *Int. J. Biol. Macromol.*, vol. 35, no. 3–4, pp. 121–125, 2005, doi: 10.1016/j.ijbiomac.2004.12.006.
9. M. Saquib Hasnain, P. Rishishwar, S. Rishishwar, S. Ali, and A. K. Nayak, "Isolation and characterization of Linum usitatisimum polysaccharide to prepare mucoadhesive beads of diclofenac sodium," *Int. J. Biol. Macromol.*, vol. 116, no. 2017, pp. 162–172, 2018, doi: 10.1016/j.ijbiomac.2018.04.151.
10. S. A. Ghumman, S. Noreen, and S. tul Muntaha, "Linum usitatissimum seed mucilage-alginate mucoadhesive microspheres of metformin HCl: Fabrication, characterization and evaluation," *Int. J. Biol. Macromol.*, vol. 155, pp. 358–368, 2020, doi: 10.1016/j.ijbiomac.2020.03.181.
11. A. K. Sachan, A. Gupta, L. Nigam, R. Sharma, and S. S. Gangwar, "Design and characterization of solid dispersion based fast dissolving tablet of Cetirizine hydrochloride," vol. 1, no. 1, pp. 37–44, 2015.
12. V. S. Meka, S. R. Dharmanlingam, V. S. Meka, and V. R. M. Kolapalli, "Formulation of gastroretentive floating drug delivery system using hydrophilic polymers and its in vitro characterization," *Brazilian J. Pharm. Sci.*, vol. 50, no. 2, pp. 431–439, 2014, doi: 10.1590/S1984-82502014000200023.
13. S. M. Razavi *et al.*, "Prediction of tablet weight variability in continuous manufacturing," *Int. J. Pharm.*, vol. 575, no. December, 2020, doi: 10.1016/j.ijpharm.2019.118727.
14. the United States Pharmacopeial Convention, "USP 1216 Tablet Friability," *Usp 28*, vol. 32, no. 2, pp. 22–24, 2016, [Online]. Available: http://www.usppf.com/pf/pub/index.html.
15. B. Bhattacharya, T. K. Ghosh, and N. Das, "Application of Bio-Surfactants in Cosmetics and Pharmaceutical Industry," *Sch. Acad. J. Pharm.*, vol. 6, no. 7, pp. 320–329, 2017, doi: 10.21276/sajp.
16. R. S. Nijhu, A. Khatun, and A. Mannan, "and esomeprazole by using natural and synthetic polymer Formulation and in vitro evaluation of bilayer floating tablet of Aceclofenac and esomeprazole by using natural and synthetic polymer," no. January, 2022.
17. S. Prajapati, P. Patel, and C. Patel, "Formulation and evaluation of sublingual tablets containing Sumatriptan succinate," *Int. J. Pharm. Investig.*, vol. 2, no. 3, p. 162, 2012, doi: 10.4103/2230-973x.104400.
18. H. Lodh, S. FR, P. K. Chourasia, and H. A. Pardhe, "Floating Drug Delivery System: A Brief Review," *Am. J. PharmTech Res.*, vol. 10, no. 4, pp. 103–122, 2020, doi: 10.46624/ajptr.2020.v10.i4.010.
19. A. D. Khan and M. Bajpai, "Floating drug delivery system: An overview," *Int. J. PharmTech Res.*, vol. 2, no. 4, pp. 2497–2505, 2010, doi: 10.52711/2231-5659.2021.00046.
20. P. Singhal, R. D. Kaushik, and V. J. Kumar, "Characterisation of Solid Dispersion Floating Tablet by Effervescent Control Release Technique with Improved Floating Capabilities," pp. 1–29.