Original Article

Formulation Development and Evaluation of Gastro Retentive Bio Adhesive Drug Delivery System for Moxifloxacin. HCl

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ABSTRACT

Objective: The purpose of present research work is to develop gastro retentive formulation for Moxifloxacin using various drug release modifiers. Moxifloxacin, novel synthetic fluoro quinolone, antibacterial agent. **Methods:** SR granules were prepared by gastro retentive tablets of Moxifloxacin. HCl were prepared using variable amounts of HPMCK100M, *Lannea coromandelica* gum (LCG) by moist granulation technique. Totally 10 SR granule formulations were prepared and subjected to precompression analysis and drug release profiles. Based on the results screening of concentrations for polymers and are used for Tablet formulations. Six tablet formulations were designed and are evaluated for various pharmacopoeial tests. Drug release profiles of formulation trails subjected to kinetic modeling. a,b,r were determined. **Results:** The results reveals that retention time decreases with decreased viscosity of polymer. F16 prepared with LCG was found to have highest swelling property. High bioadhesive strength of the formulation is likely to increase its GI residence time. *Lannea coromandelica* gum powder needs to explored as a sustain release material at commercial scale.

Key words: Moxifloxacin. HCl, Gastroretentive, Bio adhesion, HPMCK100M, Lannea coromandelica gum, Swelling Study.

INTRODUCTION

Numerous factors shows impact on effectiveness of oral delivery practice such as gastric emptying process, GI transit time, Drug release pattern from Formulation and Absorption site for drug.[1-3] The design of oral controlled Drug delivery systems (DDS) is targeted to obtain predictable and improved *in-vivo* availability. Gastric transit time in humans, influences absorption of drugs, can result inappropriate drug release from formulation leading to diminished clinical response. Gastric transit time is a dynamic process and ability to sustain the release of drug at predictive rate, which retain in the acidic environment for a longer period of time than prompt release formulations.

Several difficulties were present in front of researchers for developing controlled release systems for better absorption, improved bioavailability.[4] The controlled gastric retention of solid dosage forms may be achieved by the mechanisms of muco adhesion, flotation, sedimentation (High density), expansion, modified shape systems, or by the simultaneous administration of pharmacological agents that delay gastric emptying.[4-6]

Bioadhesive delivery systems produce many more benefits over other oral modified release systems by virtue of gastro retentivity, localization by targeting drug product at a specific site. It also proven that bioadhesive systems, they provide intimate contact between absorptive

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mucosa and dosage form which results high flux of drug through the GI mucosa.[7-11]

Gastro retentive drug delivery system (GRDDS) offer beneficial for poorly soluble drugs, by absorbing the drug from proximal portion of GIT, also by less degradation by alkaline environment which results enhanced bioavailability, clinical response due to this reduction of dose, dosing frequency, patient compliance may occur. They also offer maintenance of C_{ss} longer period of time and minimizing the risk of resistance, this is very useful for delivery of antibiotics.[12]

Materials for muco adhesive delivery are polymers of either natural, semi synthetic or synthetic, water-insoluble or hydrophilic polymers semi synthetic polymers plays vital role in the formulation of bioadhesive systems due to formation of hydrogen bonds. Hydrogen bonding is directly proportional to the adhesion strength.[13]

Materials commonly used for bio adhesion are chitosan, cholestyramine, sodium alginate, tragacanth, dextrin, hydroxyl propyl methylcellulose (HPMC), polyacrylic acid and polylactic acid, polyethylene glycol (PEG) etc. in case some polymers, it is very difficult to maintain it effectively because of the rapid turnover of mucus in the GIT.[14]

Moxifloxacin, synthetic broad spectrum antibacterial agent belongs to the class of fluoroquinolone. It has a narrow absorption window and absorbed primarily in the proximal portions of gut, an ideal candidate for a gastroretentive drug-delivery system that will prolong the gastric transit time of formulation, results enhanced bioavailability.[15,16]

An attempt is made in current study to develop gastro retentive drug delivery system (Preferably by bio adhesion) with the help of drug release rate modifiers (Natural- Lannea coromandelica gum (LCG), Semisynthetic-HPMCK100M). From the literature, very less work reported for LCG, though it is natural more benefits observed from economy point of view as well as risk incidence also low. Hence LCG selected as polymer for the formulation development of Moxifloxacin Gastro retentive delivery.[17]

A systemic approach for formulation of gastro retentive drug delivery system of Moxifloxacin with the help of polymers which prolongs the gastric transit time, improve penetrability of drug via mucosa there by improving the clinical efficacy of the active ingredient.

MATERIALS AND METHODS

Materials

A gift sample of Moxifloxacin HCl was procured from Macleods Pharmaceutical Ltd, Mumbai, India. K100M were obtained from Loba Chemie Pvt. Ltd, Mumbai, India. Lannea coromandelica Gum was gifted from Sarada Pharmaceuticals, Guntur. All other excipients such as Sodium bicarbonate, Magnesium stearate were obtained from S.D. Fine Chem. Ltd, Mumbai, India.

Preparation of Moxifloxacin. HCl Gastro Retentive Tablets

Granules were prepared by wet granulation method. Moxifloxacin HCl, polymers were dry mixed for period of 15 min. Distilled water was added as granulating liquid. The cohesive mass obtained was passed through sieve no # 12. The wet granules were dried at 60ºC for 15 min. The dried granules were passed through sieve no # 16 and were mixed with lubricants. The compositions of granules are shown in Table 1.1, 1.2.

Granules showing promising sustaining property were subjected to compression using rotary tablet punching machine (RIMEK), Ahmadabad. The composition is shown in Table 1.3. Compressed tablets were examined as per official standards and unofficial tests. Tablets were packaged in airtight and light resistance containers.

Table 1.1: Formulae for the preparation of Moxifloxacin HCl SR Granules using HPMCK100M.

Name of Ingredients	Quantity of Ingredients (mg)				
	F_1	F_2	F_3	F_4	F_5
Moxifloxacin.HCl	436.8	436.8	436.8	436.8	436.8
Lactose	121.2	91.2	61.2	31.2	1.2
HPMCK100M	30	60	90	120	150
Talc	6	6	6	6	6
Magnesium Stearate	6	6	6	6	6
Total Weight	600	600	600	600	600

Table 1.2: Formulae for the preparation of Moxifloxacin HCl SR Granules using Lannea coromandelica gum (LCG).

Name of Ingredients	Quantity of Ingredients (mg)				
	F_6	F_7	F_8	F_9	F_{10}
Moxifloxacin.HCl	436.8	436.8	436.8	436.8	436.8
Lactose	121.2	91.2	61.2	31.2	1.2
Lannea coromandelica gum (LCG)	30	60	90	120	150
Talc	6	6	6	6	6
Magnesium Stearate	6	6	6	6	6
Total Weight	600	600	600	600	600

Table 1.3: Formulae for the preparation of Moxifloxacin HCl Gastro retentive Tablets.

Name of Ingredients	Quantity of Ingredients per each Tablet (mg)					
	F_{11}	F_{12}	F_{13}	F_{14}	F_{15}	F_{16}
Moxifloxacin. HCl	436.8	436.8	436.8	436.8	436.8	436.8
Lactose	101.2	71.2	41.2	101.2	71.2	41.2
HPMCK100M	90	120	150	-	-	-
Lannea coromandelica gum (LCG)	-	-	-	90	120	150
Talc	6	6	6	6	6	6
Magnesium Stearate	6	6	6	6	6	6
Total Weight	640	640	640	640	640	640

Evaluation of Moxifloxacin. HCl Floating Tablets[18,19]

Hardness

The breaking/ crushing strength of the tablets was determined by measuring diametric breakdown of tablet using a Monsanto Tablet Hardness Tester. A hardness of about 2-4 kg/cm² is considered as preferable for optimal mechanical stability.

Friability

The friability of the tablets was carried with the help of Roche friabilator. 20 tablets were weighed noted as initial weight (W_0), these were subjected to 100 free falls from a fixed height and weighed (W) again. % friability was calculated by using following formula. The friability result should not be more than 1 %.

$$\text{Weight loss (\%)} = [W_0 - W / W_0] \times 100$$

Assay

Assay was performed by triturating stated number of tablets in pharmacopoeia (20) converted to powder, powder equivalent to 100mg of drug was added in 100 ml of 0.1 N HCl, followed by sonication. The solution was filtered through a 0.45 μ membrane filter, suitable aliquots were prepared and the absorbance of the resultant solution was measured spectrophotometrically at 288 nm using 0.1 N HCl as blank.

Thickness

Thickness formulations were determined by using vernier calipers, by placing tablet between two arms it.

Measurement of Detachment force (Muco Adhesion Strength)

Measurement of Detachment force is a measure of Adhesion strength. It is determined with the help of Texture Analyzer.

In-vitro Drug Release Study

The *In vitro* dissolution rate study for formulation trails were performed using USP XXIII type-II dissolution test apparatus containing 900 ml of 0.1 N HCl operated under conditions like temperature 37 ± 0.5°C and rotated at a speed of 50 rpm. At predetermined time intervals, 5 ml of the samples were withdrawn as per the pharmacopoeial procedure. The resultant samples were analyzed for estimation of drug release by measuring the absorbance at 288 nm using UV-Visible spectrophotometer after suitable aliquots. The samplings were performed in triplicate manner (n = 3).

The dissolution profile of all the formulations was subjected to kinetic modeling such as zero-order, first-order, Higuchi and Korsmeyer–Peppas models to know the drug release mechanisms.[15,16]

Swelling Index Study

To evaluate swelling index, tablet was placed in USP dissolution apparatus II with 900 ml 0.1N HCl after measuring the weight of tablet (W_1). Then weight of tablet (W_2) was determined by virtue of time i.e. at different time intervals viz. 1, 2, 3, 4, 5, 6, 7, 8hrs after using blotting paper to remove surplus fluid. Swelling Index was calculated using following formula.

$$\text{Swelling Index (\%)} = [(W_2 - W_1) / (W_2)] \times 100$$

RESULTS AND DISCUSSION

Gastro retentive (Bioadhesive) tablets of Moxifloxacin. HCl were prepared by using polymers such as HPMCK100M, Lannea coromandelica gum (LCG). The formulae for Moxifloxacin HCl SR granules, Tablets was presented in Table 1.1-1.3.

SR granules were subjected to flow analysis. Results were summarized in Table 2. Results reveals that all formulations are passed the limits showing good flow properties. Results for Dissolution profiles of SR granules were summarized in Table 3.1-3.2.

All formulations containing 436.8 mg Moxifloxacin HCl equivalent to 400 mg of Moxifloxacin were prepared by Wet Granulation Method. All the prepared tablets were subjected to various finished product quality control tests such as drug content, adhesion strength, mean hardness, Adhesion Time, mean thickness, friability as per pharmacopoeial methods and subjective results were summarized in Table 4. The hardness of tablets was in the range of 4.91±0.49-5.62±0.23 Kg/Cm². Weight loss in the friability test was in the range of 0.24±0.13-0.54±0.05%. Results for Drug content of final batches was found to be within the acceptable range only (94.91±0.51-98.22±0.47). Adhesion Strength

of Formulation was founded to be within the range of 211.73±6.27- 494.71±6.29mN. All formulation batches passed the Weight variation test.

The purpose of swelling study is to determine the water uptake capability of the retardant. Swelling study was performed on all formulation Trials about 24 h. From the swelling study it is found that, All formulation trails were shown swelling phenomenon when come in contact with 0.1 N HCl but stayed without breaking during the study period. Formulation F_{16} prepared with LCG was found to have highest swelling property and the data for swelling evaluation was presented in Table 5.

In vitro drug release studies were performed for formulation trials using 0.1 N HCl as a dissolution fluid as per pharmacopoeial procedures. Comparative zero order plots for formulations are shown in Figure 1-2. % Cumulative drug release (CDR) of formulations F_1-F_9 at 24 hr were found to be in the range of 99.31±2.2-100.21±1.2. % CDR against to time for formulations F_{11}-F_{16} were presented in Table 6. From the results, it reveals that amount of retardant was inversely proportional to the release rate of drug due to viscosity gradient. Hence predicted drug release can be achieved by manipulating the composition of retardants.[18,20]

variations were seen in release profiles. Formulation F_{16} containing 150 mg of LCG showed favorable dissolution parameter, which helps in meeting the primary objective of research by gastro retentivity and optimum drug release. The initial eruption of drug release is due to, by virtue of viscosity of the polymeric mixtures. The *in vitro* drug release profile of formulation trails was subjected to the goodness of fit test by linear regression analysis, with the aid of various kinetic models to know the drug release pattern from the formulation.

Table 2: Pre-Formulation Studies for Moxifloxacin. HCl SR Granules.

Formulation code	Angle of repose (0)	Compressibility index (%)	Hausner's ratio
Moxifloxacin HCl	36 .12± 1.1	26.01 ± 0.8	1.35 ± 0.18
F_1	25.17 ±0.7	17.03 ± 0.2	1.21 ±0.29
F_2	24.12 ± 1.1	17.01 ± 0.8	1.24 ±0.28
F_3	22.15 ± 1.2	20.09 ± 0.9	1.23 ± 0.2
F_4	24.12 ± 1.2	15.11 ± 0.7	1.24 ± 0.2
F_5	23.15 ± 1.1	19.16 ± 0.6	1.23 ±0.3
F_6	26 .16±0.7	15.4 1± 0.2	1.25 ±0.2
F_7	24.15 ± 1.2	17.09 ± 0.7	1.23 ± 0.2
F_8	24.12 ± 1.1	18.07 ± 0.6	1.22 ±0.2
F_9	24.12 ± 0.6	17 .11± 0.8	1.24 ±0.2
F_{10}	23.15 ±0.7	18 .16± 0.2	1.25 ±0.3

The results were presented in Table 7 and plots shown in Figures 1-9. From the results concluded that all formulations belongs to first order kinetics, R^2 values was found to be in the range of 0.899-0.980. r values of Higuchi's kinetics for factorial formulations was found to be in the range of 0.939- 0.966. *n* values for Peppas model, ranges from 1.059 to 1.263 confers drug release mechanism was non-Fickian diffusion (Super Case-II Transport) dissolution parameters for final batches was summarized in Table 8.

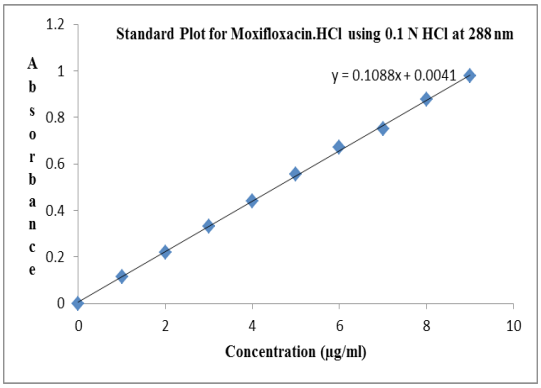

Figure 1: Standard Plot for Moxifloxacin. HCl using 0.1 N HCl as Blank at 288 nm.

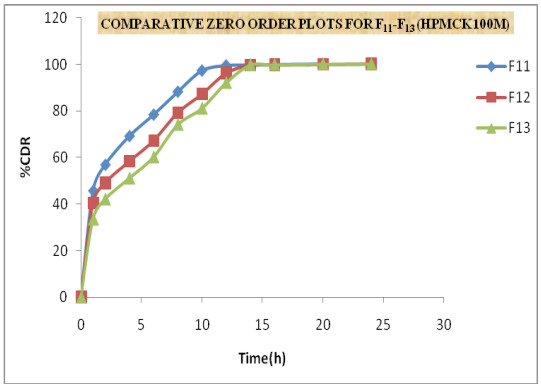

Figure 2: Comparative Zero order plots for F_{11}-F_{13}.

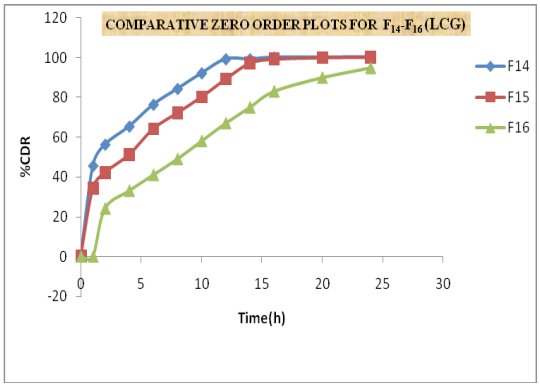

Figure 3: Comparative Zero Order Plots for F_{14}-F_{16}.

Table 3.1: *In-vitro* Dissolution data of Moxifloxacin SR Granules (HPMC K100).

Time (h)	Cumulative percent drug release (%)				
	F_1	F_2	F_3	F_4	F_5
0	0	0	0	0	0
1	66.51±2.4	58.61±3.6	50.62±2.5	48.61±2.6	40.4±3.6
2	68.71±2.3	63.71±3.2	57.82±2.2	54.23±5.1	47.12±5.1
4	91.12±2.5	81.61±2.3	77.12±1.2	68 .31±2.7	57.1±2.7
6	99.62±2.1	94.32±2.4	88.32±4.4	76.14±2.9	65.13±2.9
8	99.73±3.2	98.63±3.6	97.12±2.6	90.32±1.3	82.71±1.3
10	99.83±1.2	99.14±3.2	99.32±2.1	99.51±3.1	90.1±5.4
12	99.87±3	99.32±2.2	99.32±4.2	99.51±2.2	98.5±3.3
14	100.12±1.2	99.52±2.2	99.62±1.5	99.1±3.5	99.71±1.2
16	100.14±1.3	100.12±1.4	99.73±2.3	99.89±2.8	99.81±1.3
20	100.31±1.2	100.12±1.2	100.14±1.3	100.12±2.2	100.1±1.1
24	100.51±1.2	100.14±1.2	100.14±1.6	100.14±1.3	100.1±0.99

Table 3.2: In-vitro Dissolution Data of Moxifloxacin SR Granules (LCG).

Time	Cumulative percent drug release (%)				
	F_6	F_7	F_8	F_9	F_{10}
0	0	0	0	0	0
1	91.3±3.3	85.6±2.6	80.6±2.5	44±2.6	36.4±3.6
2	99.32±2.3	93.7±3.2	89.8±2.2	57±4.1	41±5.1
4	100±3.5	99.2±4.3	96±3.2	62±3.7	49±2.7
6	99.8±1.1	99.3±2.4	99.2±5.4	69±3.9	61±3.9
8	99.6±2.1	99.4±1.6	99.6±1.7	82±4.3	71±3.3
10	100±3.6	99.5±4.2	99.7±3.2	93.6±3.1	84±3.4
12	100.3±3.2	99.8±4.1	99.9±3.2	99.3±4.2	93±4.3
14	100±1.2	100±2.4	100±1.6	99.4±1.5	99.34±4.6
16	100±1.7	100±2.3	100±1.7	99.7±3.2	99.6±4.2
20	100±3.6	100±2.3	100±1.7	100±2.6	100±1.2
24	100±1.8	100±2.3	100±1.8	100.03±2.3	100±1.2

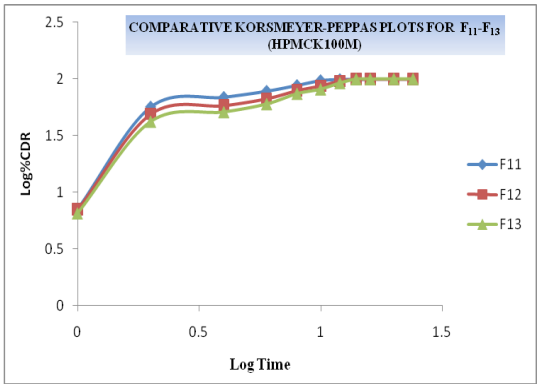

Figure 4: Comparative Korsmeyer-Peppas Plots for F_{11}-F_{13}.

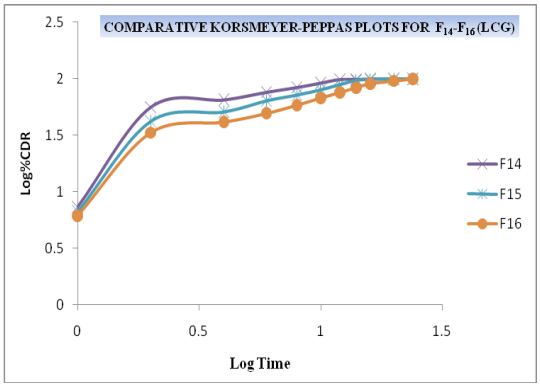

Figure 5: Comparative Korsmeyer-Peppas plots for F_{14}-F_{16}.

Table 4: Post-Compression Parameters for GR tablets of Moxifloxacin. HCl (*n*= 3).							
Formulation Code	HARDNESS (Kg/cm²)	Thickness (mm)	FRAIBILITY (%)	WEIGHT VARIATION	DRUG CONTENT (%)	Force of detachment (mN)	Adhesion Time (hr)
F_{11}	5.11±0.86	6.39±0.01	0.35±0.12	642±1	96.90±0.61	244.75±6.25	20
F_{12}	4.91±0.49	6.24±0.02	0.37±0.01	643±2	97.21±0.87	336.22±6.78	23
F_{13}	5.10±0.15	6.31±0.01	0.42±0.02	642±3	96.51±0.14	494.71±6.29	26
F_{14}	5.33±0.22	6.11±0.01	0.32±0.12	640±4	94.91±0.51	211.73±6.27	20
F_{15}	5.22±0.21	6.12±0.03	0.54±0.05	646±6	98.22±0.47	319.54±5.46	21
F_{16}	5.62 ±0.23	6.23±0.06	0.24±0.13	642±2	97.53±0.36	453.39±9.61	25

Table 5: Swelling Index of Moxifloxacin HCl GR tablets F_{11}-F_{16}.							
S.No	Time (Hours)	SWELLING INDEX (*n*=3)					
		F_{11}	F_{12}	F_{13}	F_{14}	F_{15}	F_{16}
1	0	0	0	0	0	0	0
2	1	0.97±0.1	1.45±0.3	1.5±0.4	1.10±0.2	1.73±0.3	1.67±0.3
3	2	1.19±0.2	1.95±0.4	2.02±0.4	1.07±0.1	2.30±0.4	2.4±0.5
4	4	1.32±0.3	2.26±0.2	2.14±0.25	1.15±0.2	2.78±0.5	2.89±0.6
5	8	1.64±0.3	2.88±0.5	3.26±0.4	1.43±0.2	4.30±0.4	4.4±0.4
6	12	2.41±0.4	3.41±0.4	3.55±0.3	1.8±0.3	5.25±0.3	5.4±0.3
7	24	2.89±0.4	3.64±0.3	3.67±0.3	2.35±0.2	5.32±0.4	5.53±0.3

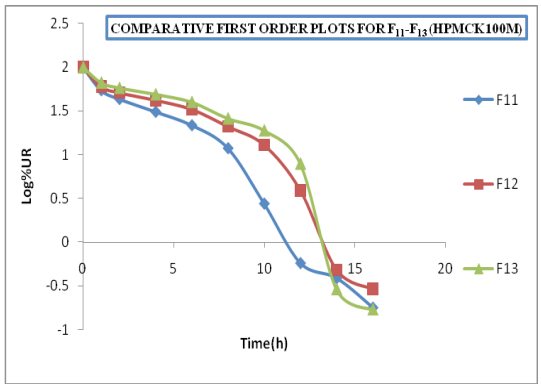

Figure 6: Comparative First Order Plots for F_{11}-F_{13}.

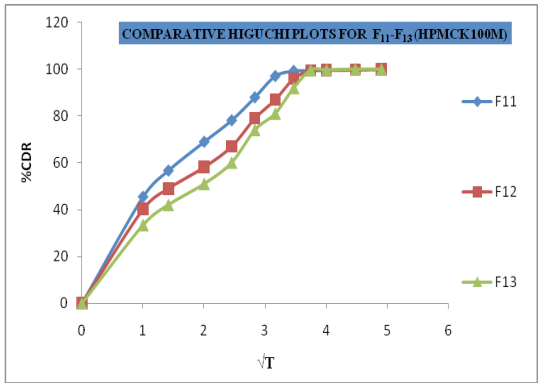

Figure 8: Comparative Higuchi Plots for F_{11}-F_{13}.

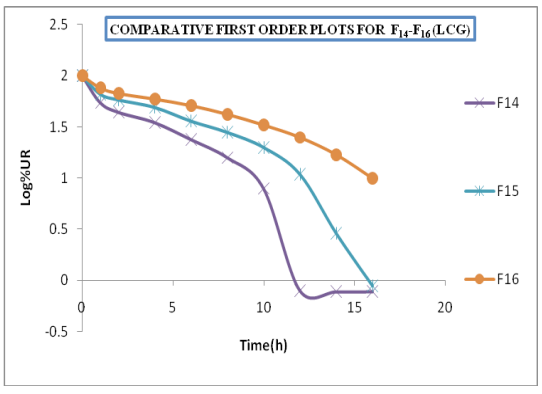

Figure 7: Comparative First Order Plots for F_{14}-F_{16}.

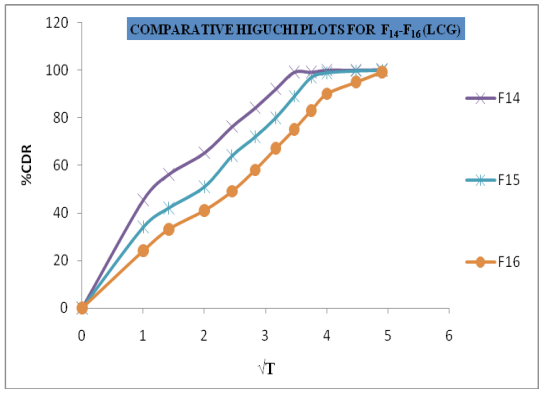

Figure 9: Comparative Higuchi Plots for F_{14}-F_{16}.

Table 6: *In-vitro* Dissolution Profile for Moxifloxacin HCl GR Tablets F_{11}-F_{16}.

Time (Hours)	*IN-VITRO* DISSOLUTION PROFILE (%CDR)					
	F_{11}	F_{12}	F_{13}	F_{14}	F_{15}	F_{16}
0	0	0	0±	0	0	0
1	45.61±3.5	40.31±2.8	33.51±4.7	45.51±4.5	34.13±4.9	24.13±3.7
2	56.8±2.2	49.1±3.9	42.12±5.1	56.21±2.2	42.14±3.8	33.14±3.8
4	69.12±5.9	58.26±4.7	51.1±2.7	65.31±5.2	51.13±5.1	41.1±3.7
6	78.32±5.4	67.14±4.9	60.16±2.9	76.32±4.6	64.13±2.7	49.12±3.9
8	88.14±4.6	79.12±1.3	74.12±3.3	84.24±4.5	72.15±3.6	58.14±5.2
10	97.23±6.7	87.14±4.1	81.13±4.3	92.13±4.3	80.16±2.5	67.13±4.6
12	99.42±3.2	96.11±3.2	92.12±5.3	99.21±2.5	89.14±2.5	75.12±3.5
14	99.61±2.5	99.52±1.2	99.71±2.9	99.23±2.2	97.13±2.8	83.14±3.5
16	99.82±3.7	99.71±1.3	99.83±2.4	100.1±2.2	99.12±1.2	90.1±2.2
20	100.1±1.9	99.83±1.2	100.11±2.2	100.12±1.1	99.91±1.2	95.01±3.7
24	100.14±1.9	100.1±1.1	100.12±2.2	100.31±1.2	100.14±1.3	99.31±2.2

Table 7: Release Kinetics of Moxifloxacin HCl GRT Formulations F_{11}-$F_{16.}$

Formulation Code	KINETIC PARAMETERS											
	ZERO ORDER			FIRST ORDER			HIGUCHI			KORSMEYER-PEPPAS		
	a	b	r	a	b	r	a	b	r	a	b	r
F_{11}	42.127	3.987	0.829	2.098	0.173	0.980	19.409	21.753	0.949	1.238	0.708	0.842
F_{12}	34.165	4.306	0.891	2.164	0.149	0.943	12.218	22.495	0.977	1.183	0.736	0.880
F_{13}	27.789	4.605	0.926	2.265	0.157	0.899	6.023	23.400	0.988	1.121	0.777	0.907
F_{14}	45.073	3.229	0.810	2.057	0.146	0.951	22.002	19.582	0.939	1.263	0.650	0.838
F_{15}	28.293	4.494	0.926	2.098	0.109	0.941	6.893	22.898	0.990	1.131	0.764	0.905
F_{16}	22.234	3.834	0.952	2.116	0.076	0.952	1.223	20.961	0.996	1.059	0.751	0.932

Where *r*: Correlation coefficient, a: Intercept, b: Slope, MP: Marketed product.

Table 8: Dissolution Parameters (Kinetic Parameters) for Formulations F_{11}-F_{16}

FORMULATION CODE	KINETIC PARAMETERS				
	$t_{10\%}$ (hr)	$t_{25\%}$ (hr)	$t_{1/2}$ (hr)	$t_{75\%}$ (hr)	$t_{90\%}$ (hr)
F_{11}	0.603	1.509	3.017	4.526	5.431
F_{12}	0.793	1.984	3.967	5.951	7.141
F_{13}	1.057	2.642	5.283	7.925	9.510
F_{14}	0.313	0.854	2.057	4.114	6.835
F_{15}	0.630	1.574	3.148	4.722	5.666
F_{16}	0.838	2.288	5.514	11.028	18.322

CONCLUSION

On the basis of the current research study, the use of polymer (Natural and Semi synthetic) had its own advantages of maintaining integrity and buoyancy of tablets. The Bio adhesive gastro retentive delivery is a promising formulation to obtain gastro retentivity by using muco adhesive polymers such as HPMCK100M and LCG.

High bioadhesive strength of the formulation is likely to increase its GI residence time and eventually improve the extent of bioavailability. Swelling studies indicated significant water uptake and contributed in drug release; swelling could also help in gastro retention. LCG showed similar sustaining and swelling properties compared to established polymers like HPMCK100. Hence Lannea coromandelica gum powder needs to explored as a sustain release material at commercial scale.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

ABBREVATIONS

SR: Sustained Release; **HPMC:** Hydroxy Methyl Propyl Cellulose; **CMC:** Carboxy Methyl Cellulose; **SCMC** : Sodium Carboxy Methyl Cellulose; **HPC:** Hydroxy Propyl Cellulose; **MCC:** Micro crystalline Cellulose; **rpm:** revolutions per minute; **BCS:** Biopharmaceutical Classification; **Kg:** Kilogram; **Cm:** Centimeter; **%:** Percentage; **mg:** Milli gram; **ml:** Milli litre; **%CDR:** Percentage Cumulative Drug Release; **UR:** Un Released; **Min:** Minute; **°C:** Degree Centigrade; **mm:** Milli meter; $t_{1/2}$**:** Half Life; **Hrs:** Hours; $t_{10\%}$**:** Time required to release 10% drug from dosage form; $t_{50\%}$**:** Time required to release 50% drug from dosage form; $t_{75\%}$**:** Time required to release 75% drug from dosage form; $t_{90\%}$**:** Time required to release 90% drug from dosage form.

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PICTORIAL ABSTRACT

Name of Ingredients	Quantity of Ingredients (mg)				
	F_1	F_2	F_3	F_4	F_5
Moxifloxacin.HCl	436.8	436.8	436.8	436.8	436.8
Lactose	121.2	91.2	61.2	31.2	1.2
HPMCK100M	30	60	90	120	150
Talc	6	6	6	6	6
Magnesium Stearate	6	6	6	6	6
Total Weight	600	600	600	600	600

Name of Ingredients	Quantity of Ingredients per each Tablet (mg)					
	F_{11}	F_{12}	F_{13}	F_{14}	F_{15}	F_{16}
Moxifloxacin.HCl	436.8	436.8	436.8	436.8	436.8	436.8
Lactose	101.2	71.2	41.2	101.2	71.2	41.2
HPMCK100M	90	120	150	-	-	-
Lannea coromandelica gum (LCG)	-	-	-	90	120	150
Talc	6	6	6	6	6	6
Magnesium Stearate	6	6	6	6	6	6
Total Weight	640	640	640	640	640	640

S.NO	Time (Hour)	SWELLING INDEX (n=3)					
		F_{11}	F_{12}	F_{13}	F_{14}	F_{15}	F_{16}
1	0	0	0	0	0	0	0
2	1	0.97±0.1	1.45±0.3	1.5±0.4	1.10±0.2	1.73±0.3	1.67±0.3
3	2	1.19±0.2	1.95±0.4	2.02±0.4	1.07±0.1	2.30±0.4	2.4±0.5
4	4	1.32±0.3	2.26±0.2	2.14±0.25	1.15±0.2	2.78±0.5	2.89±0.6
5	8	1.64±0.3	2.88±0.5	3.26±0.4	1.43±0.2	4.30±0.4	4.4±0.4
6	12	2.41±0.4	3.41±0.4	3.55±0.3	1.8±0.3	5.25±0.3	5.4±0.3
7	24	2.89±0.4	3.64±0.3	3.67±0.3	2.35±0.2	5.32±0.4	5.53±0.3

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