International Journal of Pharmaceutical Science and Research
www.pharmacyjournal.net
ISSN: 2455-4685
Received: 12-03-2026, Accepted: 12-04-2026, Published: 27-04-2026
Volume 11, Issue 2, 2026, Page No. 14-21

Formulation development and evaluation of luliconazole based emulgel for topical application

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Abstract
The aim of the current study was to develop emulgel formulation of Luliconazole that was both stable and efficacious. Luliconazole is a member of the antifungal medication class. The antifungal activity of luliconazole is strongest against *Trichophyton* species, *Aspergillus fumigatu*, *Malassezia* species, and *Candida albicans* which are the main causes of dermatophytosis. Nevertheless, luliconazole has disadvantages such lower skin retention and low aqueous solubility and poor skin penetration due to its classification as BCS Class II. The current study's goal was to develop and evaluate the emulgel system for luliconazole employing two distinct gelling agents: Carbopol 934 and HPMC K 15M with varying concentration of Light liquid paraffin and emulsifying agents. Evaluation parameters like ph, viscosity, spreadability, extrudability, drug content determination and in vitro drug release at 12 hours were carried out. On the basis of results FH3 emulgel which is HPMC K 15 M based was found to be best. Zero order drug release with non fickian diffusion kinetics was found to be the release mechanism. For physicochemical parameters, such as appearance, pH, drug content, no significant changes were observed periodically for 90 days, when compared with the initial results ensuring FH3 stability.

Keywords: Luliconazole, emulgel, carbopol 934, HPMC K 15 M, light liquid paraffin, zeroorder drug release kinetics

Introduction

Gel and emulsion are combined to create emulgels. Different medications are delivered to the skin using emulsions of the water-in-oil (w/o) and oil-in-water (o/w) types. Emulgels are a type of dose form that has a high permeability to the skin. An emulgel is developed when the gelling agent is present in the water phase of a conventional emulsion. Among the many benefits of using emulgel for dermatological purposes are its thixotropic, greaseless, readily removable, emollient, nonstaining, water-soluble, extended shelf life, bio-friendly, transparent, and aesthetically attractive properties (Hasan *et al.*2022) [8].

Luliconazole, a broad-spectrum imidazole antifungal, has emerged as an effective treatment for dermatophytic infections (Khanna & Bharti, 2014) [11]. It is especially effective against dermatophytes and other filamentous fungi. The antifungal activity of luliconazole is strongest against *Trichophyton* species, *Aspergillus fumigatu*, *Malassezia* species, and *Candida albicans* which are the main causes of dermatophytosis. Nevertheless, luliconazole has disadvantages such lower skin retention and low aqueous solubility and poor skin penetration due to its classification as BCS Class II (Hirakant & Shivappa,2023; Hasan *et al.*2022) [8, 9]. The current study's goal was to develop and evaluate the emulgel system for luliconazole employing two distinct gelling agents: Carbopol 934 and HPMCK15M with varying concentration light liquid Paraffin and emulsifying agents.

Material and Methods

Luliconazole was received as a gift sample from RS Enterprises, Jaipur. Rajasthan. All other solvent and reagent were used was of analytical grade.

Method of Preparation of Luliconazole emulgel

The preparation of Luliconazole emulgel was divided into three steps

Preparation of Gel Phase: Carbopol 934 was dissolved in purified water in the specified amount while being continuously stirred at a moderate pace to create the gel in formulation F1, F2, F3, FC1, FC2, FC3 and FC4. HPMC K 15 M was dissolved in hot purified water (80°C) to create the gel in formulation F4, F5, F6, FH1, FH2, FH3 and FH4. The resulting mixture was then allowed to cool and sit overnight. TEA (triethanolamine) was used to bring the pH of each formulation down to 5.5 to 6 (Mohamed, 2004) [13].

Preparation of Emulsion: Span 20 was dissolved in light liquid paraffin to create the emulsion's oil phase, while Tween 20 was dissolved in purified water to create the aqueous phase. In the oil phase, menthol was added (Except in formulations F1-F6). Propylene glycol was used to dissolve methyl and propyl parabens, while ethanol was used to dissolve luliconazole. Both solutions were then combined with the aqueous phase. Following separate heating of the oily and aqueous phases to 70° to 80°C, the oily phase was gradually introduced to the aqueous phase and stirred continuously until it cooled to room temperature (Mohamed, 2004) [13].

Incorporation of emulsion into gel phase: In order to produce the emulgel, the resulting emulsion and gel were combined in a 1:1 ratio while being gently stirred (Mohamed, 2004) [13]. Total Fourteen emulgels were designed. Composition of Luliconazole Emulgel is given in Table 1 and table 2.

Table 1: Composition of Luliconazole emulgel formulation with varying concentration of Polymers

Ingredients (%w/w)	F1	F2	F3	F4	F5	F6
Luliconazole	1	1	1	1	1	1
Carbopol 934	0.5	1	1.5	-	-	-
HPMC K 15 M	-	-	-	0.5	1	1.5
Light Liquid paraffin	5	5	5	5	5	5
Tween 20	0.5	0.5	0.5	0.5	0.5	0.5
Span 20	1	1	1	1	1	1
Propylene glycol	5	5	5	5	5	5
Ethanol	2.5	2.5	2.5	2.5	2.5	2.5
Methyl Paraben	0.03	0.03	0.03	0.03	0.03	0.03
Propyl paraben	0.01	0.01	0.01	0.01	0.01	0.01
Tri ethanol amine (TEA)	q.s to pH 5.5-6					
Water Up to (ml)	100	100	100	100	100	100

Table 2: Composition of Luliconazole emulgel with varying concentration of oil (Light liquid Paraffin) and emulsifying agent

Ingredients(%w/w)	FC1	FC2	FC3	FC4	FH1	FH2	FH3	FH4
Luliconazole	1	1	1	1	1	1	1	1
Carbopol 934	1	1	1	1	-	-	-	-
HPMC K 15 M	-	-	-	-	1.5	1.5	1.5	1.5
Light Liquid paraffin	5	7.5	5	7.5	5	7.5	5	7.5
Tween 20	0.5	0.5	1	1	0.5	0.5	1	1
Span 20	1	1	1.5	1.5	1	1	1.5	1.5
Propylene glycol	5	5	5	5	5	5	5	5
Ethanol	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Methyl Paraben	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Propyl paraben	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Menthol	3	3	3	3	3	3	3	3
Tri ethanol amine (TEA)				q.s to pH 5.5-6				
Water Upto(ml)	100	100	100	100	100	100	100	100

Evaluation Parameters Physical evaluation

The Emulgels' organoleptic characteristics, such as color, texture, and odor, were examined. Other physical properties such as grittiness, homogeneity, consistency, and phase separation were also screened. (Bhaware & Wankhade, 2022) [4]. The results are reported in table 3 and table 4.

Determination of pH

A digital pH meter was used to measure the emulgel's pH. Emulgel was made in a 1% aqueous solution (1 gram of emulgel in 100 ml of distilled water), and the pH was measured using a calibrated digital pH meter. The average pH value was recorded after the test was run three times (Bhaware & Wankhade, 2022) [4]. Table 5 present the findings.

Determination of viscosity

The prepared emulgel's viscosity was measured using a Brookfield viscometer. Before being measured, the Emulgels were firmly inserted into the sample holder and given 30 minutes to settle at the assay temperature (25±1 °C). It was made sure that the spindle did not hit the jar's bottom by lowering it perpendicularly into the emulgel core. Spindle number 4 was used to measure the viscosity, and the results were interpreted (Kumar et al., 2025) [12]. **Table 5** incorporate the viscosity finding.

Determination of Spreadability

By measuring the spreading diameter of 0.5 g of emulgel placed within a circle with a pre-marked diameter of 1 cm on a glass plate, over which another glass plate weighing 75 gm was placed, the spreadability of the emulgel formulations was ascertained 48 hours after production. For five minutes, a 425 g weight was left on the upper glass plate with no further spreading anticipated. The increase in the diameter due to spreading of the gels was noted. The spreadability (g.cm/sec) was calculated by using the formula:

S=M.L/T

Where: S = Spreadability

M= the weight of the upper plate and weight rested on it (g), L =the diameter of the spreading emulgel (cm), and T = the time taken (Seconds). (Navaneetha *et al*. 2017) [14].

The results are reported in Table 5.

Determination of Extrudability

Standard collapsible aluminum tubes with caps were filled with the gel formulations, and the ends were crimped shut. The tubes' weights were noted down. The tubes were clamped between two glass slides. After covering the slides with 500 g, the cap was taken off. Weighing was done on the quantity of extruded gel. The following formula was used to get the percentage of the extruded gel.

$$\text{Extrudability} = \frac{\text{Amount of gel extruaded from the tube} \times 100}{\text{Total amount of gel filled in the tube}}$$

>90% extrudability: Excellent, >80% extrudability: Good, and >70% extrudability: Fair) (Asija et al.2015; Giri & Bhalke, 2019) [3, 7]. The results are reported in Table 5.

Determination of Drug content

Determining the amount of drug contained in a specific quantity of the formulation was the goal of the drug content analysis. A 10 ml volumetric flask is filled with about 1 g of the prepared emulgel from each batch. 1 ml of ethanol is then added, and the remaining volume is adjusted with 5.5 phosphate buffer. In a shaker, the volumetric flask was fully mixed after being left to settle for two hours. A spectrophotometer was used to detect the absorbance at 299 nm after the solution had been filtered through filter paper and the mixer. It was obtained from the standard equation by placing the concentration of the absorbance value and drug material (Kumar et al. 2025) [12]. The percent drug content of Luliconazole from emulgel was tabulated in table 6.

***In-Vitro* Drug Release Study**

A modified Franz diffusion cell was used for the *in vitro* drug release investigations (FD). The formulations were used on a 0.45 μm pore-size dialysis membrane that was positioned between the FD cell's donor and receptor compartments. As a dissolving medium, phosphate buffer with a pH of 5.5 was employed. Hot water was circulated through the jacket to keep the cell's temperature at 37°C. A magnetic bead was used to continually agitate the fluid while the entire assembly was held on a platform with a magnetic induction point. Spectrophotometric analysis of the samples was performed at 299 nm, and the percentage of drug released at 0, 1, 2, 4, 6, 8, 10, and 12 hours was computed (Pakhare *et al*. 2017) [15]. The results of *In-vitro* drug release of F1-F6, FC1-FC4 and FH1-FH4 are reported in figure 1,2 and 3 respectively.

Drug Release Kinetics

Numerous mathematical models, including the Higuchi matrix, the Korsmeyer-Peppas models, the Hixson Crowell model, the zero-order and first-order kinetic models, were used to study the drug release kinetics. The gathered information on drug dissolving *in vitro* was integrated into these graphical models in order to investigate the mechanism for releasing and release rate kinetics of the dosage form (Costa & Lobo, 2001; Gangurde, 2011) [5, 6]. The best-fit model in this case was chosen by contrasting the obtained r^2 values. The graphs were plotted for all the models as including Zeroorder (Figure 4), First-order (Figure 5), Higuchi equation (Figure 6), Hixson-Crowell (Figure 7) and Korsemeyer-Peppas (Figure 8), and results are illustrated in table 7.

Stability Studies

The ICH guidelines are followed for conducting the stability investigations. In accordance with ICH requirements, stability testing was performed on the optimized Emulgel formulation. Clean, lacquered, collapsible aluminum tubes were used to hold the emulgel, and different replicates were maintained in a humidity chamber at 40 ± 1°C and 75% ± 5% relative humidity. At intervals of 30, 60, and 90 days, Emulgel's appearance, pH, and percentage of drug content were evaluated (Kumar *et al*., 2025) [12]. Table 8 displays the stability study's findings.

Results and Discussion Physical Appearance

The color of all the formulations were found to be White to Off-white. The Off-white color may be appeared due to the presence of menthol in formulation FC1-FH4. Formulations F1-F6 were found to be odorless whereas in formulations FC1-FH4 odor was found to be characteristic due to the presence of menthol. The texture of all the prepared emulgel batches were found to be smooth.

The color, odor and texture of Marketed Formulation (M.F) of Luliconazole emulgel are white, odorless and smooth respectively. Results are reported in table 3.

Table 3: Organoleptic properties of Luliconazole emulgels

S.no	Formulations	Color	Odor	Texture
1	F1	White	Odorless	Smooth
2	F2	White	Odorless	Smooth
3	F3	White	Odorless	Smooth
4	F4	White	Odorless	Smooth
5	F5	White	Odorless	Smooth
6	F6	White	Odorless	Smooth
7	FC1	Off-White	Characteristic	Smooth
8	FC2	Off-White	Characteristic	Smooth
9	FC3	Off-White	Characteristic	Smooth
10	FC4	Off-White	Characteristic	Smooth
11	FH1	Off-White	Characteristic	Smooth
12	FH2	Off-White	Characteristic	Smooth
13	FH3	Off-White	Characteristic	Smooth
14	FH4	Off-White	Characteristic	Smooth
15	M.F	White	Odorless	Smooth

Following centrifugation, all of the formulations retained their homogenous, uniform, single-phase appearance and were physically stable. It shows that there is no coalescence, breaking, or separation of the emulsion into watery and oily layers, and that it is evenly distributed throughout the gel network. The homogeneous nature of prepared emulgels indicates that the emulsion (oil/water) is perfectly integrated with the gel foundation, giving the gel a uniform, consistent appearance. When applied to the skin, all of the formulations were found to be non-gritty, with a smooth, creamy, and homogeneous texture that was totally devoid of any lumps, aggregates, or solid particles. Results of physical properties of prepared emulgels are incorporated in table 4.

Table 4: Physical Properties of Luliconazole emulgels

S.no	Formulations	Phase separation	Homogeneity	Consistency	Grittiness
1	F1	None	Uniform	Good	Non-gritty
2	F2	None	Uniform	Good	Non-gritty
3	F3	None	Uniform	Good	Non-gritty
4	F4	None	Uniform	Good	Non-gritty
5	F5	None	Uniform	Good	Non-gritty
6	F6	None	Uniform	Good	Non-gritty
7	FC1	None	Uniform	Good	Non-gritty

8	FC2	None	Uniform	Good	Non-gritty
9	FC3	None	Uniform	Good	Non-gritty
10	FC4	None	Uniform	Good	Non-gritty
11	FH1	None	Uniform	Good	Non-gritty
12	FH2	None	Uniform	Good	Non-gritty
13	FH3	None	Uniform	Good	Non-gritty
14	FH4	None	Uniform	Good	Non-gritty
15	M.F	None	Uniform	Good	Non-gritty

pH

The pH of the formulation was in the range of 5.63 ± 0.31 to 6.17 ± 0.16, which lies in the normal pH range of skin, indicating its skin compatibility and would not produce any irritation to Skin. The pH of marketed luliconazole emulgel was found to be 5.79 ± 0.56. Results are reported in table 5.

Table 5: pH, Viscosity, Spreadability and Extrudability Data of luliconazole emulgels

S.no	Formulations	pH	Viscosity (Cps)	Spreadability (gm.cm/sec.)	Extrudability (%)
1	F1	5.89 ± 0.03	13430±5.45	14.9±0.33	85.57
2	F2	6.17 ± 0.16	13718±8.14	13.5 ±0.27	81.14
3	F3	5.73 ± 0.38	13926±9.05	12.8±0.45	79.19
4	F4	5.72 ± 0.25	12318±4.23	17.8±1.03	92.14
5	F5	5.74 ± 0.28	12626±6.21	17.4±0.51	91.01
6	F6	5.94 ± 0.16	13000±3.11	15.6±0.28	87.17
7	FC1	5.64 ± 0.11	13600 ±8.45	14.2±0.19	83.94
8	FC2	5.71 ± 0.08	13822 ±5.07	13.0±0.51	82.28
9	FC3	6.04 ± 0.09	12900 ±4.18	16.2±0.12	89.06
10	FC4	5.78 ± 0.28	13510 ±5.23	14.5±0.13	84.05
11	FH1	5.77 ± 0.62	13050± 3.29	15.1±0.06	86.17
12	FH2	5.63 ± 0.31	13660 ±6.04	13.9±0.27	83.23
13	FH3	5.71 ± 0.15	12768± 7.43	16.5±1.04	89.34
14	FH4	5.68 ± 0.22	12961 ± 6.62	15.9±0.06	88.29
15	M.F	5.79 ± 0.56	12668 ± 5.33	15.5±0.11	89.27

*All the values are expressed as mean± SD, n=3.

Viscosity

The measured viscosity ranged from 12318 ±4.23 to 13926 ± 9.05 Cps. The commercial luliconazole emulgel was found to have a viscosity of 12668 ±5.33Cps. The viscosity of the carbopol 934-based formulations was higher than that of the HPMC K 15 M-based formulations. As the polymer content rises, so does viscosity. Formulation F3, which had Carbopol 934 at a concentration of 1.5%, had the maximum viscosity, whereas formulation F4, which contained HPMC K 15M at a concentration of 0.5%, had the lowest. The formulation with the lowest viscosity, which demonstrates superior spreadability and is therefore more advantageous for the largest quantity of drug release, contained 5% (w/w) of light liquid paraffin, 1% (w/w), and 1.5% (w/w) of tween 20 and span 20 respectively. The result of viscosity is incorporated in Table 5.

Spreadability

The result of Spreadability is incorporated in Table 5. Emulgels were found to be spreadable between 12.8±0.45 and 17.8±1.03 gm.cm/sec. Marketed luliconazole emulgel was found to have a spreadibility of 15.5±0.11 gm.cm/sec. Compared to emulgel based on carbopol, the emulgel formulation including HPMC K 15M has demonstrated the highest spreadability. Better spreadability on the skin is demonstrated by the formulation with a lower liquid paraffin content.

Extrudability

The viscosity and consistency of the formulation are the primary determinants of the extrudability test, which is a crucial consideration when assessing semisolid dosage forms. Better extrudability is exhibited by low viscosity formulations, leading to increased patient compliance (Khan *et al*. 2022) [10]. Table 5 present the extrudability data for luliconazole emulgels. With the exception of the F3 formulation, most of the other formulations showed good extrudability. Extrudability for Formulations F4 and F5 was seemed to be excellent. It was discovered that the marketed luliconazole emulgel had good extrudability.

Drug Content

One crucial factor that has a direct impact on the therapeutic effectiveness of any pharmaceutical dosage form is the uniformity of the drugs content. The percent drug content of Luliconazole from formulated emulgels were tabulated in table 6.

Table 6: Drug content of Luliconazole emulgel

S. No.	Formulation Code	Drug content (%)
1	F1	93.1 ± 0.43
2	F2	93.4 ± 0.31
3	F3	92.1 ± 0.72
4	F4	94.7 ± 0.42
5	F5	93.9 ± 0.50
6	F6	94.2 ± 0.48
7	FC1	93.8 ± 0.25
8	FC2	93 ± 0.31

9	FC3	95.1 ± 0.26
10	FC4	94.2 ± 0.48
11	FH1	94.5 ± 0.25
12	FH2	93.5 ± 0.31
13	FH3	95.6 ± 0.66
14	FH4	94.8± 0.26
15	M.F	95.8 ± 0.74

*All the values are expressed as mean± SD, n=3.

The drug content of prepared emulgel was found to be in the range of 92.1 ± 0.72 to 95.6 ± 0.66 %. The result of drug content of Marketed Luliconazole emulgel was found to be 95.8 ± 0.74 %. The results of percent drug contents showed that the drug was uniformly distributed, and the result was within the limit (90–110%) according to US Pharmacopeia.

***In-vitro* Drug release studies**

The release of a drug from pharmaceutical dosage forms determines its therapeutic efficacy. The release of a drug from pharmaceutical dosage forms determines its therapeutic efficacy. At the conclusion of the eighth hour, the F1 formulation with 0.5% carbopol 934 exhibits 96.26±2.16 % drug release, although not in a sustained way. In contrast, F4 with HPMC K 15 M (0.5%) exhibits 97.87±2.09 percent drug release at the end of the eighth hour, but again not in a sustained manner.

Therefore, in order to achieve prolonged release, the polymer concentrations were further raised. After 12 hours, the F2 formulation with Carbopol 934 (1%) exhibits an 81.16±2.36 percent drug release. In contrast, the F5 formulation with HPMC K15M (1%) exhibits a 70.08± 1.20 percent drug release after 12 hours. After 12 hours, formulation F3 exhibits a 75.87±0.88 percent drug release due to an increase in the concentration of Carbopol 934 (1.5%). But formulation F6 containing HPMC K15 M (1.5%) shows 84.54±2.28 % drug release at 12th Hours. So, formulation F2 in case of Carbopol 934 and F6 in HPMC 15 K M is considered as the optimized formulation as it releases sufficient amount of drug in sustained manner at the end of 12hrs. The results of *Invitro* Drug Release study of the emulgels with varying concentration of Polymers (gelling agent) Carbopol 934 and HPMC K 15M is shown in figure 1.

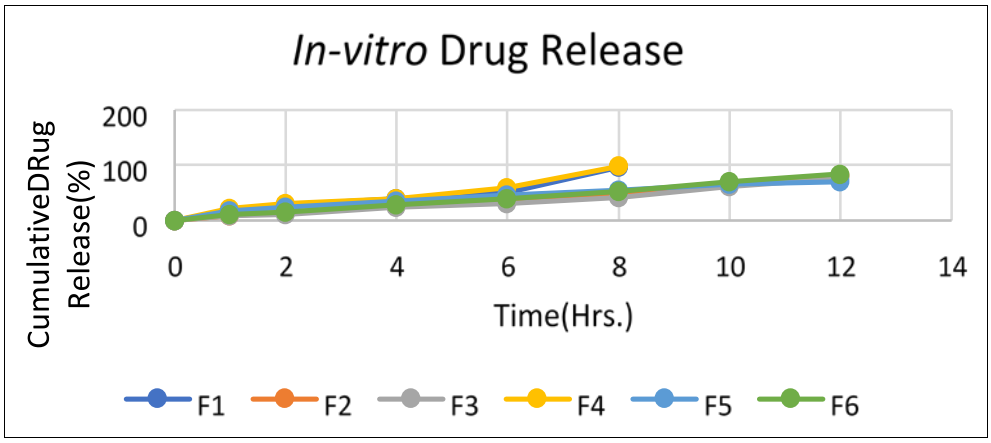

Fig 1: *In-vitro* Drug Release of Luliconazole emulgels (F1-F6)

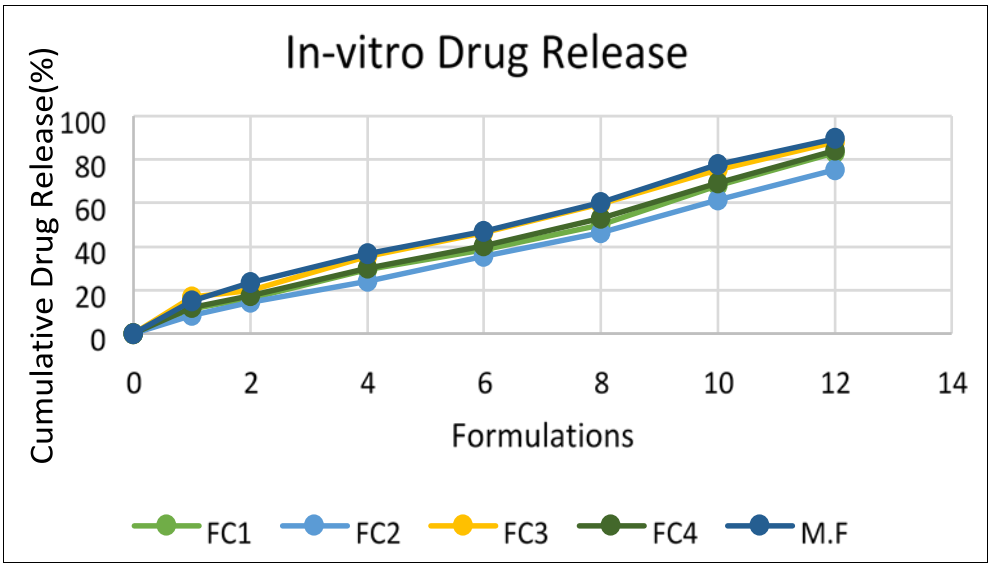

Fig 2: *In-vitro* Drug Release of Luliconazole emulgels (FC1-FC4)

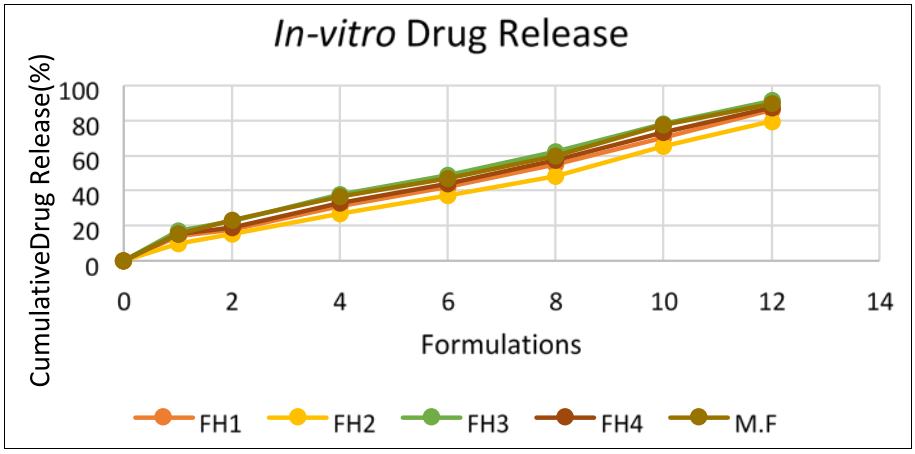

Fig 3: *In-vitro* Drug Release of Luliconazole emulgels (FH1-FH4)

The results of *In-vitro* drug release of Luliconazole emulgels FC1-FC4 and FH1-FH4 are reported in Figure 2 and 3 respectively.

FH3 > FC3 > FH4 > FH1 >FC4 > FC1 > FH2 > FC2 is the descending order in which the drug luliconazole release from its emulgel formulations can be ranked. The amounts of drug released at 12 hours were 91.27%, 88.04%, 87.38%, 86.03%, 84.15%, 83.16%, 79.65%, and 75.27%, respectively. After 12 hours, the in-vitro drug release of the marketed luliconazole emulgel was determined to be 89.53± 2.36 percent. Formulations FH3 and FC3 showed the highest drug release. This observation might be explained by the fact that both of these formulations contain low levels of Light liquid paraffin and high levels of the emulsifying agent, which increase the emulgel's hydrophilicity and make it easier for the release medium to penetrate and for the drug to diffuse out of the emulgel. According to Abd El-Bary *et al*. (Abd El-Bary A *et al*., 2001) [1], the presence of liquid paraffin caused the release of chloramphenicol from its emulgel formulation to be delayed. This conclusion was consistent with their findings. Formulation FC3, which is based on carbopol, had a lower drug release than formulation FH3, which is based on HPMC K 15 M. This could be because carbopol has a higher viscosity. The drug's entrapment in the Carbopol 934 network structure could also be the cause (Abd El-Bary A *et al*. 1992) [2]. The formulations with the lowest drug release were FH2 and FC2, in contrast to FH3 and FC3. The emulsifying agent is at the low level in formulations FH2 and FC2, whereas liquid paraffin is in the high level. Compared to formula FH1, which contained both liquid paraffin and the emulsifying agent in low levels, formula FH4, which contained both liquid paraffin and the emulsifying agent in high levels, demonstrated higher drug release. This result showed that the emulsifying agent's enhancing effect on drug release was more noticeable than liquid paraffin's decreasing effect. The FC4 and FC1 formulations showed the same finding. Despite being based on Carbopol, FC3 had a higher drug release than FH4, which is based on HPMC K 15 M. This conclusion results from formula FC3's decreased liquid paraffin concentration compared to formula FH4. This also applies to FC1 and FH2. This result demonstrated that liquid paraffin had a greater impact on reducing drug release from the emulgel than HPMC K 15 M did on increasing drug release. As a result, these variables can be ranked as follows based on how they affect the drug release from emulgel formulations: the concentration of the emulsifying agent > the concentration of liquid paraffin > the kind of gelling agent. FH3 formulation was found to release maximum amount of drug (91.27± 2.35) in controlled manner at the end of 12 hours. So FH3 emulgel is further taken for the Drug release kinetics study and stability study.

Drug Release Kinetics

The data of drug release of Optimized formulation FH3 was fitted into various kinetic models, including Zero-order, First-order, Higuchi equation, Hixson-Crowell equation and KorsemeyerPeppas. The graphs were plotted for all the models as including Zero-order (Figure 4), First-order (Figure 5), Higuchi equation (Figure 6), Hixson-Crowell (Figure 7) and Korsemeyer-Peppas (Figure 8), and results are illustrated in table 7.

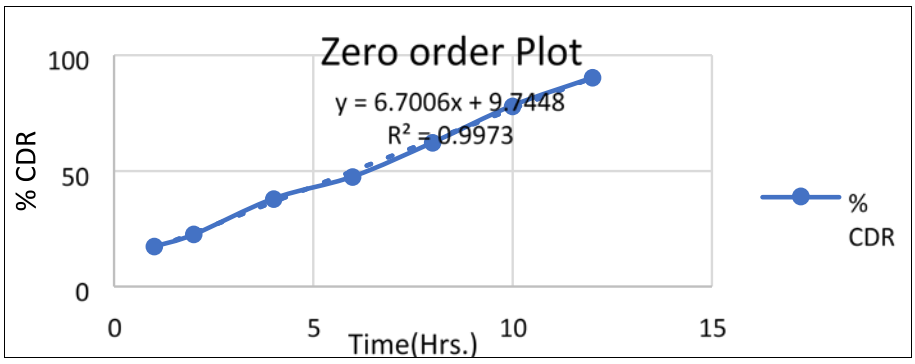

Fig 4: Zero order kinetic plot of Optimized emulgel FH3

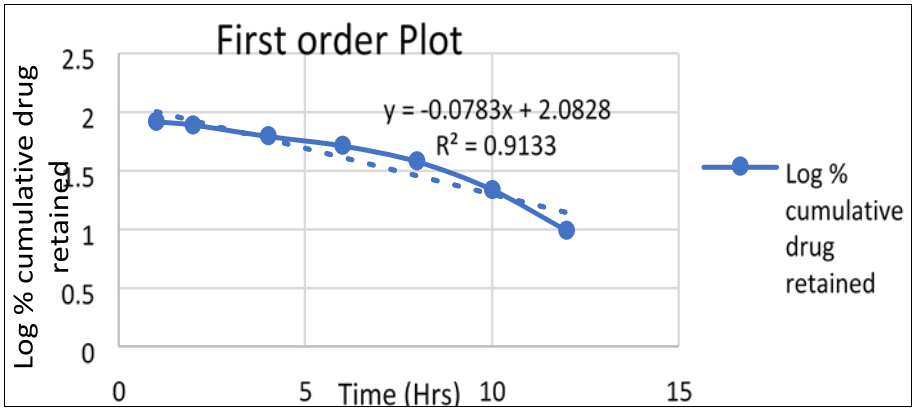

Fig 5: First order kinetic plot of Optimized emulgel FH3

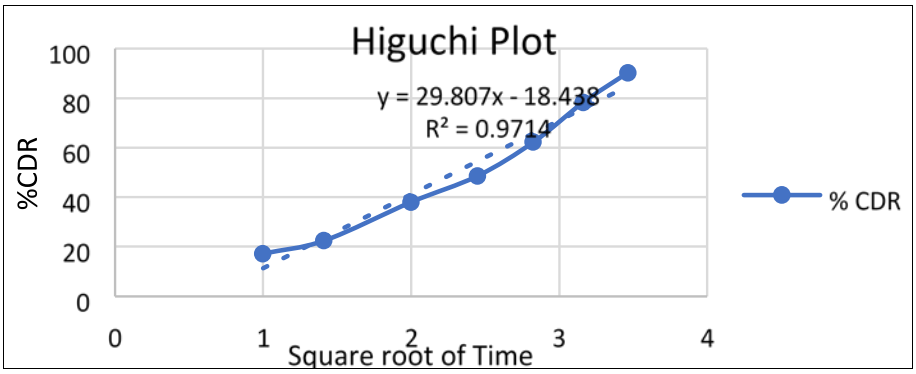

Fig 6: Higuchi kinetic plot of Optimized emulgel FH3

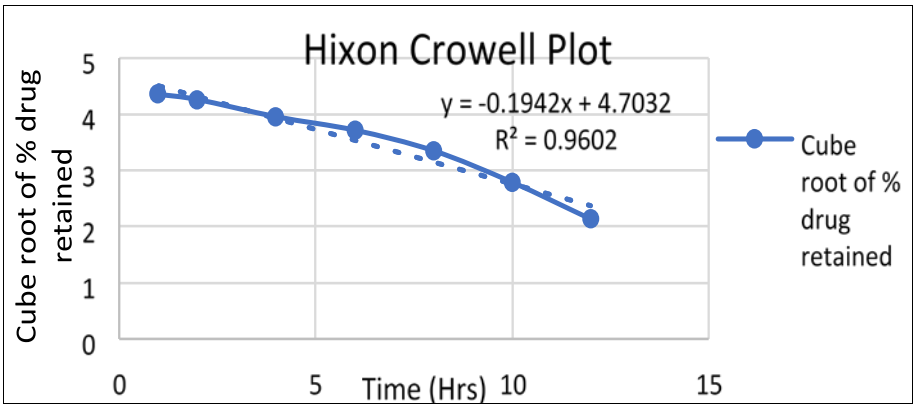

Fig 7: Hixon Crowell kinetic plot of Optimized emulgel FH3

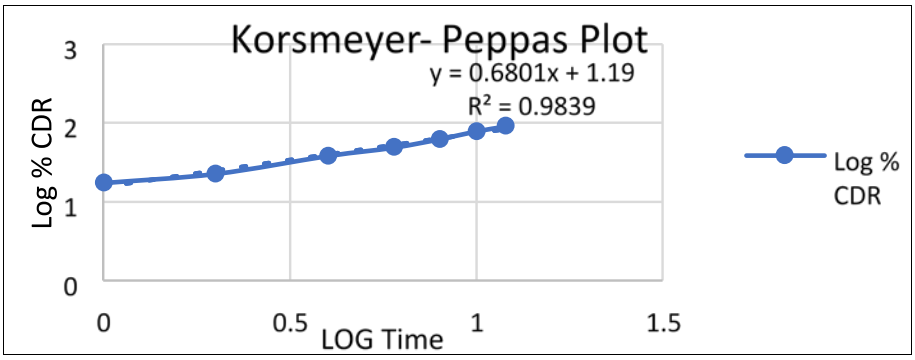

Fig 8: Korsmeyer Peppas kinetic plot of Optimized emulgel FH3

Table 7: Data of Release Kinetics of Optimized Formulation FH3

Formulation Code	Correlation coefficient (R^2)					Diffusion Exponent 'n'
	Zero order	First order	Higuchi	Hixson	Korsmeyer Peppas	
FH3	0.997	0.913	0.971	0.960	0.983	0.68

The curve fitting for several models was found done and the n value was found to be 0.68. In Zero order, graph was plotted between cumulative percentage drug released versus time and was observed to be linear with the higher regression coefficient value of was r2= 0.997. From the above data, it was concluded that optimized Emulgel formulation FH3 follows Zero order drug release kinetics. The exact mechanism of which was confirmed by fitting the data in KorsmeyerPeppas model, where the regression coefficient was found to be 0.983 with release exponent n = 0.68 which is more than 0.45 but less than 1. Hence, it was ascertained that the drug is releasing through anomalous non- Fickian diffusion.

Stability Study

FH3 was chosen as the Optimized emulgel from the drug release results and was employed for stability study. By choosing FH3 emulgel as optimized formulation, the stability study was carried out for six months. Stability studies have been conducted in accordance with ICH Guidelines on formulations. For physicochemical parameters, such as appearance, pH, drug content, no significant changes were observed periodically when compared with the initial results ensuring formulation stability. The appearance of the emulgels were observed on all test days for any colour changes or phase separation. As per the observation, there are no significant changes in the formulation's physical appearance, pH and drug content were observed. Results of stability study are shown in Table 8.

Table 8: Stability Study of FH3 Stored at 40°C /75% RH

Tested After Days	Physical Appearance	pH	% drug content
0	Off-white, No Phase Separation	5.71 ± 0.15	95.6 ± 0.66
30	Off-white, No Phase Separation	5.71 ± 0.09	95.6 ± 0.59
60	Off-white, No Phase Separation	5.69 ± 0.24	95.5 ± 0.07
90	Off-white, No Phase Separation	5.66 ± 0.55	95.4 ± 0.03

*All the values are expressed as mean± SD, n=3.

Conclusion

According to the findings, the FH3 Emulgel of 1% w/w of Luliconazole with polymer 1.5% HPMCK 15 M, 5 % Light liquid paraffin with 1% and 1.5 % w/w of Tween 20 and Span 20 respectively, can be considered as an ideal for optimized emulgel formulation, because it meets all of the requirements for emulgel, and study encourages further clinical trials on this formulation. Based on the results obtained with the current research, it can be concluded that emulgels will be better promising drug delivery approach for Luliconazole to enhance and achieve controlled drug release in comparison to its conventional formulations.

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