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Research Article

Formulation and Evaluation of Controlled-Release Repaglinide Tablets Using Eudragit RS100 and Carbopol P974 NF Polymer Combinations

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Abstract

Repaglinide is a short-acting insulin secretagogue whose short half-life necessitates frequent dosing, compromising adherence. Controlled-release (CR) matrix tablets combining hydrophobic and hydrophilic polymers can sustain drug release and reduce dosing frequency. To formulate and evaluate CR repaglinide tablets using Eudragit RS100 and Carbopol P974 NF at varying drug: polymer ratios, with and without natural co-excipients, and to characterise their physicochemical properties, in vitro release, and release kinetics. Nine formulations (CR-R1–CR-R9) were prepared by direct compression and wet granulation at drug: polymer ratios of 10:1, 10:2 and 10:3, with gum acacia and guar gum as co-excipients in selected batches. Pre-compression (Carr's index, Hausner's ratio, angle of repose) and post-compression (weight variation, thickness, hardness, friability, drug content) parameters were assessed per pharmacopeial standards. In vitro release was studied by USP Method I and modelled with the Power Law equation; similarity (f2) and difference (f1) factors were calculated against a reference product. Data were analysed by one-way ANOVA with Tukey's post hoc test. All blends showed excellent-to-very-good flow (Carr's index 9.22–11.88%; Hausner's ratio 1.06–1.16; angle of repose 29.99–31.94 °). All tablets met pharmacopeial limits for weight variation, hardness (6.5–7.2 kg/cm^2), friability (<0.5%) and drug content (97.1–99.7%). Drug release at 2 hours ranged from 77.0% to 92.0%. Power Law fitting (r^2 = 0.988–0.997) indicated anomalous non-Fickian diffusion (n = 0.608–0.790) for all formulations. Eudragit RS100–Carbopol P974 NF matrices produced robust, pharmacopeia-compliant repaglinide CR tablets with diffusion/erosion-controlled release, supporting this polymer combination for sustained oral repaglinide delivery.

Keywords

Repaglinide, Controlled-release Matrix Tablets, Eudragit RS100, Carbopol P974 NF, Drug Release Kinetics

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1. Introduction

Type 2 diabetes mellitus (T2DM) is a chronic metabolic disorder that requires long-term pharmacological management to maintain glycaemic control and prevent complications. Repaglinide, a meglitinide-class insulin secretagogue, stimulates rapid but short-lived insulin release from pancreatic β-cells; however, its short plasma half-life necessitates multiple daily doses, which increases pill burden and can reduce patient adherence [6, 12]. Controlled-release (CR) oral drug delivery systems are designed to maintain therapeutically effective plasma drug concentrations over a prolonged period, reduce peak-trough fluctuations associated with immediate-release dosing, and lower dosing frequency, thereby improving convenience and compliance [1, 17].

Matrix-based CR tablets, formulated using hydrophilic and/or hydrophobic rate-controlling polymers, remain among the most widely used approaches to sustained oral delivery because of their formulation simplicity, cost-effectiveness, and manufacturing scalability [8, 19]. Hydrophobic polymers such as Eudragit RS100 form a largely insoluble but permeable matrix that regulates drug diffusion, whereas hydrophilic polymers such as Carbopol swell on contact with aqueous fluid to form a gel layer that controls release through a combination of diffusion and erosion [13, 28]. Combining polymers with complementary release-controlling mechanisms has been reported to provide finer control over drug-release kinetics than either polymer used alone, an approach previously applied to other poorly compliant, short half-life drugs such as losartan potassium and diacerein [7, 10, 16].

Several studies have investigated sustained or controlled-release delivery of repaglinide through alternative platforms, including Box–Behnken-optimised matrix tablets [14], thiolated mucoadhesive tablets [2], xanthan-gum hydrogel particles [18], mucoadhesive buccal tablets [25, 26], chitosan-based hydrogels [3], and nanosuspensions [12]. However, comparatively little work has examined Eudragit RS100–Carbopol P974 NF combination matrices for repaglinide, particularly in combination with natural co-excipients such as gum acacia and guar gum, which may further modulate powder flow and release behaviour [9, 29, 30].

The present study was therefore designed to formulate controlled-release repaglinide tablets using Eudragit RS100 and Carbopol P974 NF at varying drug: polymer ratios, with and without co-excipients, and to comprehensively characterise their pre- and post-compression physicochemical properties, in vitro dissolution behaviour, release kinetics, and similarity to a commercially available reference product.

2. Materials and Methods

2.1. Study Design

The present study was designed to formulate and evaluate controlled-release repaglinide tablets using different combinations of hydrophilic and hydrophobic polymers. Pre- and post-formulation physicochemical properties and the in vitro drug-release pattern were determined to identify the optimum polymer combination for sustained drug delivery.

2.2. Chemicals and Equipment

All chemicals used were of analytical grade and were used without further purification. Repaglinide was gifted by a pharmaceutical company. Eudragit RS100 was obtained from Rohm GMBH (Germany), and Carbopol P974 NF was obtained from Lubrizol (Wickliffe, OH, USA).

Table 1. *Chemicals used in the present study.*

S. No.	Chemicals Used
1	Methocel
2	Ethocel
3	Magnesium stearate
4	HPMC
5	Evocil
6	Distilled water
7	Phosphate buffer (pH 6.8 and 7.4)

The Department of Pharmaceutics provided the following equipment: a UV-Visible double-beam spectrophotometer (Shimadzu, Germany), a Pharma Test dissolution apparatus (Hamburg, Germany), a digital Vernier caliper, a friabilator, a hardness tester (Erweka, Germany), and a digital electronic balance.

Table 2. *Equipment used in the present study.*

S. No.	Equipment Used
1	Weighing balance
2	pH meter
3	Friabilator
4	Hardness tester
5	Volumetric flasks
6	UV spectrophotometer
7	Petri dish
8	Magnetic stirrer

S. No.	Equipment Used
9	Filter paper
10	Stainless steel spatulas, etc.

2.3. Formulation of CR Tablets

Controlled-release tablets were formulated using Eudragit RS100 and Carbopol P974 NF at drug: polymer (D:P) ratios of 10:1, 10:2 and 10:3 [16]. Drug dose was held constant at 20 mg while the total polymer content increased with the D:P ratio. Spray-dried lactose served as the filler and magnesium stearate as the lubricant. In selected batches, gum acacia and guar gum replaced 10% of the filler as co-excipients [10]. Tablet compositions are shown in Tables 3 and 4.

Table 3. *Composition of CR tablets of repaglinide (without co-excipient).*

D:P Ratio	Repaglinide (mg)	Eudragit RS100 + Carbopol P974 NF (mg)	Spray-dried Lactose (mg)	Mg Stearate (mg)	Total (mg)
10:1	10	3	77.85	0.5	100
10:2	10	6	75.15	0.5	100
10:3	10	9	72.45	0.5	100

Table 4. *Composition of CR tablets of repaglinide with co-excipient (gum acacia/guar gum).*

D:P Ratio	Repaglinide (mg)	Eudragit RS100 + Carbopol P974 NF (mg)	Spray-dried Lactose (mg)	Mg Stearate (mg)	Total (mg)
10:1	10	3	86.5	0.5	100
10:2	10	6	83.5	0.5	100
10:3	10	9	80.5	0.5	100

2.4. Tablet Preparation

The drug and polymers were mixed using a pestle and mortar, after which the filler was added and mixed again. The lubricant was added and blended after passing the mixture through a No. 32 mesh sieve; the powder blend was then passed through the sieve a second time to ensure homogeneity. A single-punch tableting machine (Erweka, Germany) was used to compress each powder blend into tablets, with hardness maintained between 5 and 10 kg/cm^2. For formulations without co-excipient, a polyvinylpyrrolidone (PVP) solution was used as a wet-massing agent, and the resulting mass was granulated through a No. 20 sieve. Granules were dried and passed through a No. 40 sieve prior to compression to minimise clumping.

2.5. Pre and Post-Compression (Physicochemical) Evaluation

Powder blends were evaluated for angle of repose, Carr's compressibility index, and Hausner's ratio to assess suitability for tablet compression.

The prepared tablets were evaluated against pharmacopeial standards, including physical appearance (colour, shape, smoothness, and surface defects, assessed visually), weight variation (20 tablets per formulation weighed individually and compared with the average weight per USP specifications), thickness (10 tablets measured with a Vernier caliper), hardness (10 tablets tested with a hardness tester), and friability "20 tablets tested in a friabilator; acceptance criterion <1% weight loss" [27].

2.6. Drug Content Uniformity

Ten tablets were pulverised, and a precisely weighed amount equivalent to one tablet was dissolved in phosphate buffer. At predetermined intervals, 5 mL samples were withdrawn, filtered, and analysed spectrophotometrically over 200–400 nm. Drug release was quantified against a repaglinide standard curve, with each experiment performed in triplicate [4].

2.7. Standard Calibration Curve of Repaglinide

A calibration curve was constructed by UV-visible spectrophotometry using repaglinide solutions of 2–20 µg/mL scanned across 200–400 nm [20]. Maximum absorbance (λmax) was observed at 283 nm, and a linear concentration-absorbance relationship confirmed compliance with the Beer-Lambert law and the suitability of the method for drug estimation.

2.8. Effect of Drug: Polymer Ratio

Formulations were developed at varying D:P ratios to examine their effect on drug-release kinetics. Drug content was held constant across formulations while total polymer content increased proportionally with the D:P ratio.

2.9. In Vitro Drug Release and Release Kinetics

In vitro release testing was performed using pharmaceutical dissolution equipment per USP Method I (rotating basket) [22]. Release data were fitted to the Power Law model:

$$Mt / M\infty = K \cdot t^{n}$$

Where, $Mt/M\infty$ is the fraction of drug released at time t, K is the release rate constant, and n is the release exponent, which characterises the release mechanism [5]. Diffusion is classified as quasi-Fickian when n = 0.5, anomalous (non-Fickian) when 0.5 < n < 1, and zero-order (Case-II transport) when n = 1.

2.10. Similarity and Difference Factors

Dissolution profiles of the developed CR matrix tablets were compared with the dissolution profile of Raptrol® (an immediate-release repaglinide reference product manufactured by Wilshire, Pakistan) using the difference factor (f1) and similarity factor (f2) [15]:

$$f1 = \{[\Sigma^{n}t=1 |Rt - Tt|] / [\Sigma^{n}t=1 Rt]\} \times 100$$

$$f2 = 50 \times \log \{[1 + (1/n) \Sigma^{n}t=1 (Rt - Tt)^{2}]^{-0.5} \times 100\}$$

Where, R_t and T_t are the percentage drug dissolved from the reference and test formulations, respectively, at each time point, and n is the number of time points. Conventionally accepted ranges are f1 = 0–15 (difference) and f2 = 50–100 (similarity).

Data are expressed as mean ± standard deviation (SD). Statistical analysis was performed using SPSS version 25. Differences across formulations were examined using one-way analysis of variance (ANOVA) with Tukey's post hoc test; $p < 0.05$ was considered statistically significant [23, 24].

3. Results

3.1. Flow Properties of Powder Blends

All nine powder blends showed flow properties within pharmacopeial acceptance limits (Table 5). Carr's compressibility index ranged from 9.22 ± 0.45% (CR-R4) to 11.88 ± 0.56% (CR-R5); Hausner's ratio ranged from 1.06 ±0.41 (CR-R1) to 1.16 (CR-R3, CR-R5, CR-R7); and angle of repose ranged from 29.99 ±0.32 °(CR-R4) to 31.94 ±1.14 °(CR-R5). Formulations CR-R1, CR-R2, CR-R4, CR-R6 and CR-R8 were classified as having excellent flow, while CR-R3, CR-R5, CR-R7 and CR-R9 were classified as very good, indicating that all blends were suitable for direct compression/tableting.

Table 5. *Flow properties of powder blends for controlled-release repaglinide formulations.*

Formulation	Compressibility Index (%) (USP <15%)	Hausner's Ratio (USP 1.00–1.25)	Angle of Repose (°) (USP 25–35 °)	Interpretation
CR-R1	9.85 ±0.89	1.06 ±0.41	30.03 ±0.25	Excellent
CR-R2	10.02 ±0.43	1.15 ±0.45	31.67 ±0.33	Excellent
CR-R3	11.46 ±0.76	1.16 ±0.16	31.87 ±0.45	Very good
CR-R4	9.22 ±0.45	1.10 ±0.44	29.99 ±0.32	Excellent
CR-R5	11.88 ±0.56	1.16 ±0.59	31.94 ±1.14	Very good
CR-R6	10.65 ±0.71	1.15 ±0.30	30.76 ±1.34	Excellent
CR-R7	11.77 ±0.44	1.16 ±0.37	31.66 ±1.15	Very good
CR-R8	10.43 ±1.52	1.14 ±0.22	30.38 ±0.18	Excellent
CR-R9	11.39 ±2.14	1.15 ±0.34	31.23 ±0.22	Very good

3.2. Post-Compression Evaluation

All formulations complied with pharmacopeial specifications (Table 6). Tablet weight ranged from 247.5 ± 2.2 mg (CR-R2) to 253.1 ± 2.0 mg (CR-R8), within ±5% of the target weight. Thickness was uniform across all formulations (4.24–4.31 mm). Hardness ranged from 6.5 ± 0.3 kg/cm^2 (CR-R1) to 7.2 ± 0.2 kg/cm^2 (CR-R6), within the 5–8 kg/cm^2 acceptance range. Friability remained below 1% for all batches (0.35–0.49%), confirming adequate mechanical strength, and drug content ranged from 97.1 ± 0.5% (CR-R6) to 99.7 ± 0.5% (CR-R5), within the USP-Acceptable 95–105% range.

Table 6. *Post-compression evaluation of controlled-release repaglinide tablet formulations.*

Formulation	Weight Variation (mg) ±5%	Thickness (mm)	Hardness (kg/cm^2) 5–8	Friability (%) <1%	Drug Content (%) 95–105%
CR-R1	251.3 ± 1.7	4.31 ± 0.04	6.5 ± 0.3	0.49 ± 0.02	99.5 ± 0.5
CR-R2	247.5 ± 2.2	4.25 ± 0.03	6.8 ± 0.2	0.48 ± 0.03	97.2 ± 0.7
CR-R3	251.4 ± 1.5	4.24 ± 0.06	6.7 ± 0.1	0.41 ± 0.01	99.2 ± 0.4
CR-R4	248.7 ± 1.9	4.29 ± 0.05	6.8 ± 0.3	0.38 ± 0.01	98.3 ± 0.5
CR-R5	252.1 ± 2.1	4.28 ± 0.02	7.1 ± 0.2	0.37 ± 0.01	99.7 ± 0.5
CR-R6	250.1 ± 0.9	4.31 ± 0.02	7.2 ± 0.2	0.37 ± 0.03	97.1 ± 0.5
CR-R7	248.5 ± 2.1	4.29 ± 0.03	7.1 ± 0.2	0.39 ± 0.01	99.3 ± 0.4
CR-R8	253.1 ± 2.0	4.28 ± 0.02	7.05 ± 0.1	0.35 ± 0.03	98.6 ± 0.5
CR-R9	250.1 ± 1.0	4.30 ± 0.03	7.1 ± 0.1	0.37 ± 0.03	99.4 ± 0.7

3.3. In Vitro Dissolution Study

Cumulative drug release at 1 h ranged from 28.03% (CR-R3) to 38.50% (CR-R1); at 1.5 h, from 37.07% (CR-R4) to 59.03% (CR-R7); and at 2 h, from 77.04% (CR-R5) to 92.03% (CR-R8) (Table 7). Formulations with the lowest polymer proportion (D:P 10:1) generally released drug fastest at early time points, whereas increasing the proportion of Carbopol P974 NF (10:2 and 10:3 ratios) tended to slow early release, consistent with the greater gel-forming and viscosity-building capacity of Carbopol at higher polymer loading.

Table 7. *Dissolution study of controlled-release tablets of repaglinide.*

Formulation	Time 1 h (%)	Time 1.5 h (%)	Time 2 h (%)
CR-R1	38.50	52.07	87.02
CR-R2	31.01	43.01	83.03
CR-R3	28.03	39.03	87.03
CR-R4	31.03	37.07	92.02
CR-R5	33.05	45.03	77.04
CR-R6	32.01	47.03	82.03
CR-R7	36.05	59.03	86.03
CR-R8	29.04	56.05	92.03
CR-R9	31.03	47.01	90.03

3.4. Drug Release Kinetics

Power Law modelling gave r^2 values between 0.988 and 0.997 across all nine formulations, indicating a good fit (Table 8). The release exponent (n) ranged from 0.608 (CR-R4) to 0.790 (CR-R2), consistent with anomalous (non-Fickian) diffusion for every formulation i.e., drug release governed jointly by diffusion through the polymer matrix and polymer chain relaxation/erosion, rather than by diffusion or erosion alone.

Table 8. *Release kinetics and mechanism of CR tablets at various drug: polymer ratios.*

Formulation	Power Law Model (r^2)	N	Mechanism
CR-R1	0.995	0.678	ANFD
CR-R2	0.997	0.790	ANFD
CR-R3	0.993	0.704	ANFD
CR-R4	0.992	0.608	ANFD
CR-R5	0.989	0.652	ANFD
CR-R6	0.995	0.655	ANFD
CR-R7	0.988	0.746	ANFD
CR-R8	0.994	0.631	ANFD
CR-R9	0.990	0.652	ANFD

Note: ANFD: Anomalous non-Fickian diffusion

3.5. Similarity and Difference Factors

When compared with the reference product (Raptrol®), calculated difference factor (f1) values ranged from 54.76 (CR-R8) to 88.56 (CR-R2), and similarity factor (f2) values ranged from 6.23 (CR-R8) to 12.43 (CR-R6) (Table 9). These calculated values fall outside the conventionally accepted ranges ($f1 \leq 15$; $f2 \geq 50$) in both directions and are addressed further under Limitations.

Table 9. *Difference (f1) and similarity (f2) factors of test formulations versus the reference product.*

Test Formulation vs Reference	f1 value	f2 value
CR-R1 vs Reference	85.10	10.65
CR-R2 vs Reference	88.56	9.33
CR-R3 vs Reference	79.45	11.57
CR-R4 vs Reference	76.65	9.36
CR-R5 vs Reference	71.67	7.87
CR-R6 vs Reference	78.78	12.43
CR-R7 vs Reference	82.34	9.56
CR-R8 vs Reference	54.76	6.23
CR-R9 vs Reference	56.87	7.98

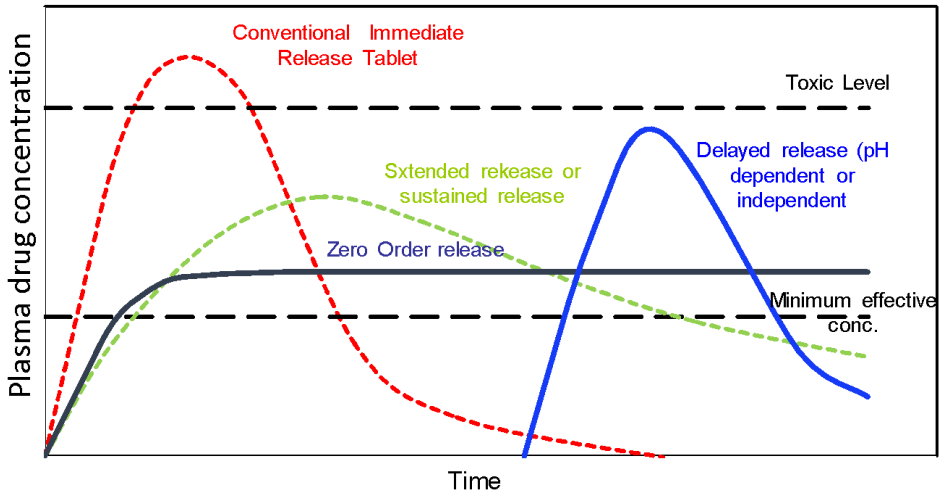

Figure 1. *Schematic plasma drug-concentration profiles for conventional immediate-release, extended/sustained-release, zero-order, and delayed-release dosing.*

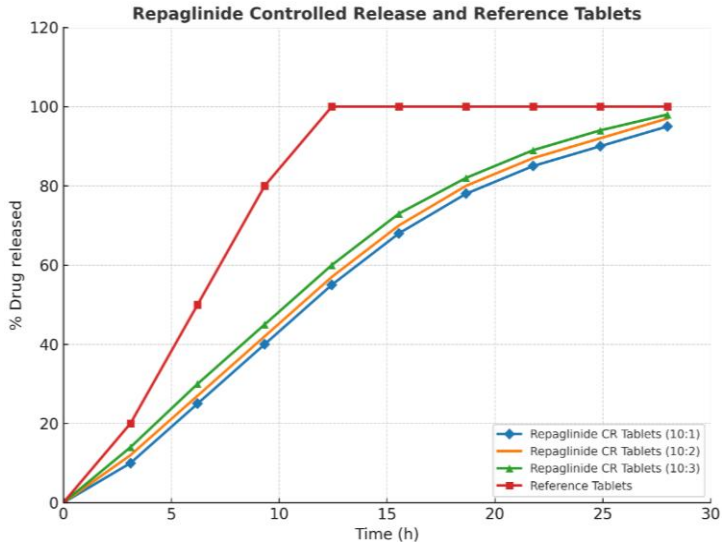

Figure 2. *In vitro drug-release profiles of controlled-release repaglinide tablet formulations (CR-R1–CR-R9) versus the reference product.*

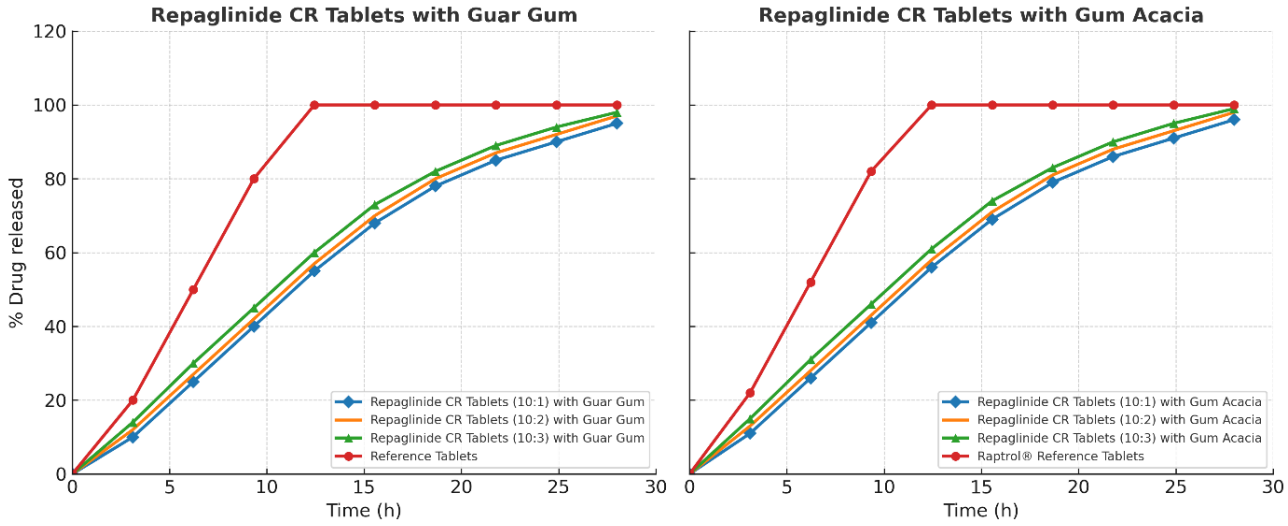

Figure 3. *Drug-release characteristics of repaglinide CR tablets formulated with guar gum and gum acacia co-excipients.*

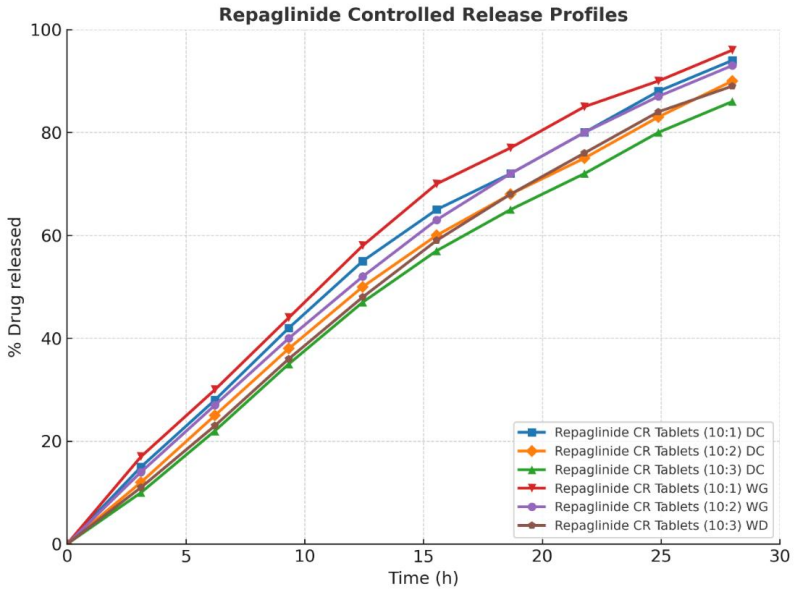

Figure 4. *Drug-release characteristics of repaglinide from all controlled-release tablet formulations.*

4. Discussion

The present study demonstrates that combining a hydrophobic polymer (Eudragit RS100) with a hydrophilic polymer (Carbopol P974 NF) can yield mechanically robust, pharmacopeia-compliant controlled-release repaglinide tablets. The excellent-to-very-good flow properties observed across all nine blends (Carr's index 9.22–11.88%; Hausner's ratio 1.06–1.16) are comparable to those reported by Khan et al. (2022) [16] for losartan potassium controlled-release matrices formulated with Ethocel and Carbopol 934P, in which similar drug: polymer blending strategies produced powder blends suitable for direct compression. Likewise, Razaque et al. (2017) [22], working with glipizide — another oral antidiabetic — reported acceptable flow and post-compression parameters for polymer-based CR matrix tablets, supporting the general reproducibility of matrix-forming polymer blends across structurally distinct antidiabetic actives.

Post-compression parameters in the present study, including hardness (6.5–7.2 kg/cm^2), friability (<0.5%), and drug content uniformity (97.1–99.7%), were consistent with pharmacopeial requirements and align closely with the ranges reported by Rabani et al. (2022) [21] for Eudragit RL100-based controlled-release famotidine tablets and by Gupta and Patra (2023) [14], who optimised repaglinide sustained-release matrix tablets using a Box–Behnken design. The comparable mechanical performance across these studies suggests that Eudragit-based matrices, irrespective of the specific grade or co-polymer partner, reliably produce tablets that withstand routine handling while maintaining structural integrity during dissolution testing.

The release-kinetic analysis indicated anomalous (non-Fickian) diffusion (n = 0.608–0.790) for all nine formulations, implying that drug release was governed by the simultaneous diffusion of repaglinide through the swollen/porous polymer matrix and relaxation or erosion of the polymer chains, rather than by a purely diffusion- or erosion-controlled mechanism. This finding is consistent with the mechanistic behaviour described for hydroxypropyl methylcellulose (HPMC)-based and related hydrophilic-hydrophobic matrix systems by Padro et al., (2026) [18] and by Ellakwa et al. (2024) [11], who likewise reported non-Fickian release exponents for HPMC-based sustained-release quetiapine matrices. It is also consistent with the review by Kumar et al. (2024) [17] on oral controlled-release matrix tablets, which identifies polymer swelling and erosion as the dominant release-controlling mechanisms in mixed hydrophilic-hydrophobic matrix systems [13]. Similarly, showed that the release-controlling behaviour of water-insoluble polymer matrices is strongly influenced by polymer particle properties and compression conditions, which may explain the moderate variability in the release exponent (n) observed between formulations in the present study despite their similar composition.

The inclusion of gum acacia and guar gum as co-excipients — an approach analogous to that used by Danish et al. (2023) [10] in sustained-release diacerein hydrogels — appeared to modestly influence both early- and late-stage drug release, likely reflecting the additional swelling and viscosity-building contribution of these natural gums alongside the synthetic polymer matrix. This mirrors the observation of Berardi et al. (2019) [7] that co-excipients can meaningfully alter the swelling and drug-release performance of polymer matrix tablets, even when the primary rate-controlling polymer is unchanged.

Compared with alternative repaglinide delivery platforms reported in the literature including thiolated mucoadhesive tablets [2], xanthan-gum hydrogel particles [19], mucoadhesive buccal tablets [26], and chitosan-based hydrogels [3]

the Eudragit RS100–Carbopol P974 NF matrix system evaluated here offers a comparatively simple, direct-compression/wet-granulation-based manufacturing route consistent with the broader case made by Adepu and Ramakrishna (2021) [1] and Bhadane et al. (2024) [8] for matrix tablets as a practical, scalable first-line approach to controlled oral drug delivery. However, unlike the mucoadhesive and hydrogel-particle approaches, which are designed to extend residence time at an absorptive site, the present matrix system relies solely on bulk polymer swelling/erosion, which may limit the maximum achievable release duration a point discussed further below.

The calculated similarity (f2) and difference (f1) factors relative to the reference product fell outside the ranges conventionally used to infer dissolution equivalence, in both directions simultaneously (f1 values markedly higher, and f2 values markedly lower, than the accepted cut-offs). Because the reference product (Raptrol®) is an immediate-release formulation while the test products are controlled-release matrices, a lack of similarity is expected and, in this context, is evidence that the intended release-rate modification was achieved rather than a formulation deficiency; nonetheless, the magnitude and internal consistency of the f1/f2 values warrant recalculation and verification, as discussed under Limitations.

5. Limitations

The evaluation was restricted to in vitro testing; no in vivo pharmacokinetic, bioavailability, or bioequivalence data are available to confirm that the in vitro release advantage translates into a clinically meaningful extension of plasma drug levels.

The calculated f1 (difference) and f2 (similarity) values fell outside conventional acceptance ranges in both directions simultaneously, which is numerically unusual; these calculations should be independently re-verified before being used to support equivalence or non-equivalence claims.

Dissolution testing was limited to three time points (1, 1.5, and 2 hours); a longer sampling window with more time points would allow more precise characterisation of the complete release profile and total release duration.

No accelerated or long-term stability data (e.g., ICH-condition storage studies) were generated to assess the physical, chemical, and dissolution stability of the tablets over time.

Comparison was limited to a single commercial reference product (Raptrol®); comparison against additional marketed or literature-reported repaglinide formulations would strengthen the generalisability of the findings.

6. Conclusion

Controlled-release repaglinide tablets formulated using combinations of Eudragit RS100 and Carbopol P974 NF, at drug: polymer ratios of 10:1, 10:2 and 10:3 and with or without gum acacia/guar gum co-excipients, exhibited acceptable pre-compression flow properties and met pharmacopeial specifications for weight variation, thickness, hardness, friability, and drug content. In vitro release over the studied 2-hour period ranged from 77.0% to 92.0%, and release-kinetic modelling indicated an anomalous non-Fickian diffusion mechanism across all nine formulations. These findings support the feasibility of the Eudragit RS100–Carbopol P974 NF polymer combination, with natural co-excipients, as a viable platform for controlled oral delivery of repaglinide, warranting further optimisation and in vivo evaluation.

Abbreviations

CR	Sustained Release
USP	United States Pharmacopeia
PVP	Polyvinylpyrrolidone
HPMC	Hydroxypropyl Methylcellulose
CR-R	Control Release Repaglinide

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Author Contributions

Haseena Ghaffar: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Project administration, Visualization

Ghulam Mustafa Shahwani: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Project administration, supervision & visualization

Abdul Ghaffar: Data curation, Formal Analysis, Visualization, writing–review & editing

Ghulam Razzaq Shahwani: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Project administration, Visualization, writing–review & editing

Rasheed Ahmed: Visualization, writing–review & editing

Marvi: Data curation, Resources

Conflicts of Interest

The authors declare no conflict of interest.

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