ejpmr, 2024, 11(10), 248-252

SJIF Impact Factor 7.065

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Research Article

ISSN 2394-3211

EJPMR

"CREATION AND ASSESSMENT OF CURCUMIN-EMBEDDED SUPPOSITORIES THROUGH THE MACERATION PROCESS"

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Article Received on 19/08/2024 **Article Revised on 01/09/2024** **Article Accepted on 20/09/2024**

ABSTRACT

Suppositories provide a different way to administer medicine, especially for people who can't take oral prescriptions because of nausea, vomiting, or swallowing issues, or who have vaginal or rectal infections. Using a glycerol-gelatin basis, this research looks into the formulation and assessment of suppositories containing curcumin. Turmeric produces curcumin, a bioactive molecule known for its anti-inflammatory, antioxidant, and anticancer effects, but its poor bioavailability hinders its oral absorption. We used a glycerol-gelatin basis, known for its hydrophilic characteristics, to improve the solubility and release of curcumin at body temperature. We assessed numerous physicochemical characteristics of the prepared suppositories, including visual characterisation, weight fluctuation, hardness, melting point, disintegration, and dissolution. The suppositories successfully released curcumin due to their constant melting point, appropriate hardness, and homogenous weight. Tests on the formulation's capacity to distribute curcumin effectively via dissolution and disintegration provided further confirmation. According to the study, curcumin-based suppositories made with a glycerol-gelatin base could be a good way to improve curcumin's bioavailability and therapeutic efficacy for people who can't take it by mouth, especially in situations where its therapeutic properties can be used effectively.

KEYWORDS: Suppositories, Rectal, Curcumin, Glycerol-gelatin, bioavailability, Anti-inflammatory, Anticancer.

INTRODUCTION

Curcumin is a naturally occurring polyphenolic compound that is found in the rhizomes of Curcuma longa (turmeric). It has gotten a lot of attention because it has a lot of different medical uses.[1,2] It is well-documented for its anti-inflammatory, antioxidant, anticancer, and antimicrobial properties, making it a promising candidate for various therapeutic applications.[3,4] Despite these benefits, curcumin's clinical utility is limited by its poor bioavailability, which is largely due to its low solubility in water, rapid metabolism, and systemic elimination.[5] Researchers are exploring alternative dosage forms like suppositories to enhance the bioavailability of curcumin and enable localised delivery, particularly in the treatment of lower gastrointestinal tract disorders.[6] Suppositories are solid dosage forms designed for insertion into body cavities, such as the rectum, vagina, or urethra, where they melt, soften, or dissolve to deliver localised or systemic effects.[7] The composition of suppositories, including the choice of base, plays a critical role in their effectiveness and rate of drug release.[8] The extraction of curcumin was achieved through a maceration process using ethanol as the solvent, followed by the preparation of suppositories via the moulding method.

Historically, suppositories were made from substances like cocoa butter or gelatin, evolving over time with advances in formulation technology.[9] Rectal suppositories, for instance, are particularly useful for patients who have difficulty swallowing oral medications and are commonly employed for both local and systemic therapeutic purposes, including as laxatives, analgesics, and antiemetics.[10]

MATERIAL AND METHODS

Materials

Turmeric: The most prevalent polyphenol found in the culinary spice turmeric is called curcumin. It is made by extracting the powdered rhizomes of Curcuma longa, a member of the Zingiberaceae family.[11] It is made up of 1, 7-bis (4-hydroxy-3-methoxyphenyl)-1, 6-heptadiene-3, and 5-dione; diferuloylmethane, a yellow bioactive pigment[12], is what turmeric is mostly made of. Curcumin has been shown in several investigations to possess broad-spectrum antimicrobial action, including antibacterial, antiviral, antifungal, and antimalarial

properties.[13] Curcumin exhibits antifungal properties against the Candida albicans strain. A suppository is a solid medication dose type that is meant to be used in the urethra, vagina, and rectum.[14] Using ethanol as the macerating solvent, turmeric powder that was bought from the Kishanganj, Bihar, local market was macerated for 24 hours in order to extract the curcumin. The resulting filtrate was dried in a rotary evaporator operating at reduced pressure for three to four days at 50 degrees Celsius. Dry extract was used for the formulation. **Refer figure. 1**

Formulation Process

A clear solution was created by heating 70% glycerol and 30% gelatine to a temperature of 100 °C, which was then used to make the suppository basis. Until the mixture was homogeneous, the curcumin extract was gradually stirred into the heated glycerol-gelatine base. **Refer table 1**. This combination was left to stand for thirty minutes in order to allow the air bubble in the suppository base to escape. After cooling and lubricating with castor oil, the fluid was poured into suppository moulds. The filled suppository mould was allowed to firm for about half an hour at a temperature below 25°C without being moved. The suppositories were collected and kept in a dry, cold location.[15] ***Refer Figure 2.***

EVALUATION OF SUPPOSITORIES

We assessed the manufactured suppositories using a variety of formal and informal criteria, such as visual weight variation, content homogeneity, hardness, melting point, disintegration test, and macro-melting range test.

1. Visual characterisation: We sliced the suppositories lengthwise and inspected them while the wearer was nude to subjectively evaluate their look, colour, and surface uniformity.[16]

2. Width and length: We measured the length and width of ten randomly selected suppositories using a micrometre screw gauge and a vernier calliper, respectively.[17]

3. Variations in weight: We determined the average weight by weighing each of the twenty randomly selected suppositories from the prior test.[18]

4. Hardness testing: We allocated 10 suppositories to a Monsanto hardness tester to determine their tensile strength and capacity to withstand packaging risks.[19]

5. Melting point: The suppository formulation is used for the macro melting range test, and it is placed in a beaker with phosphate buffer pH 6.8 and kept at a constant temperature of 37±0.5℃. We observed the duration required for the entire suppository to dissolve or disperse within the medium.[20]

6. Disintegration: For this test, we produced phosphate buffer, pH 6.8, to serve as a disintegrating solvent. We evaluated the breakdown of six samples using a tablet disintegrator. We placed a single suppository into each cylindrical glass, then raised and lowered it in the buffer solution. We recorded the disintegration time when the suppository completely crumbled.[21]

7. Test of Dissolution: We conducted the dissolution test in USP rotating basket dissolution equipment (Pharmatest, Type PTW Germany) using 900 millilitres of Sorensen's phosphate buffer with a pH of 7.3. The temperature was kept at 37±0.5°C, and the rotation speed was regulated at 50 rpm. We removed five millilitre aliquots of the dissolving fluid from the reservoir at predetermined intervals and replaced them with an equal amount of brand-new dissolving medium each time. We diluted the withdrawn samples appropriately and examined them at 400 nm using a Shimadzu PR240 in Kyoto, Japan. Plotting the absorption versus time using phosphate buffer pH 7.4 resulted in a linear relationship. $Y = 0.05845 X + 0.001$ ($r=0.99998$).[22]

RESULT AND DISCUSSION

1. Visual Appearance: The suppositories formulated were bullet shaped, yellow-orange in colour and with a characteristic odour. The longitudinal section shows absence of pitting, fat blooming, exudation, and migration of the active ingredients.

2. Length and width: The average width of the suppositories was found to be 1 cm and the average length was 2.5 cm.

3. Weight variations: The twenty randomly selected suppositories from previous test were weighed individually and the average weight was calculated. No suppositories deviated from average weight by more than 5%. **Refer Table 2.**

4. Hardness: The hardness range of suppository preparations is 5 to 6 kg/cm2. However, increasing the concentration of gelatine in the formulation leads to higher hardness values. ***Refer Table 3.***

5. Melting point: The suppository formulations had a melting point that varied between 36.5°C and 37.5°C.

6. Disintegration time: Generally, a rectal suppository should dissolve in 30 to 32 minutes or less. We recorded an average disintegration and dissolving time of 32 minutes, easily falling within the permissible range.

7. Dissolving test: We used Sorensen's phosphate buffer at pH 7.4 as the dissolving medium for the disintegration of curcumin suppositories. The entire drug release underwent in vitro dissolution for sixty minutes. We measured the absorbance in a UV-Vis spectrophotometer between 300 and 500 nm, and recorded the maximum absorbance between 399 and 406 nm. This number indicates that first-order kinetics govern the release of curcumin. **Refer Figure 3 & 4, also table 4.**

Figures

Figure 1 Extraction of Curcumin from Turmeric.

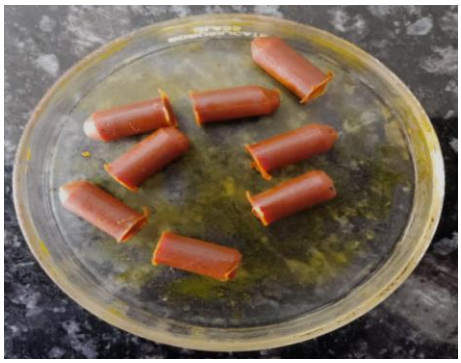

Figure 2 Formulated Curcumin Suppository.

Figure 3: Shows the data interpreted by UV-Visible Spectro photometer which shows the highest absorbance from the range 391-410nm. Among this range at 399nm-406nm we observed the highest absorbance of 0.466.

Figure 4: Standard calibration curve which was of 500nm with absorbance of 0.019.

Tables

Table 1: Formulation Table Ingredients of Curcumin suppository.

S.N.	Material / Apparatus List	Amount
1	Turmeric Powder	2 g
2	Ethanol (95%)	500ml
3	Glycerol	70 ml
4	Gelatine	30 g
5	Castor Oil	Q. S.

Table 2: Weight Variation study for Curcumin Suppository.

S.N.	Suppositories (g)	Weight Variation (g)	% Variation
1	1.52	0.00	0.00 %
2	1.54	0.02	1.31 %
3	1.53	0.01	0.65 %
4	1.55	0.03	1.97 %
5	1.51	-0.01	- 0.65 %
6	1.51	-0.01	- 0.65 %
7	1.56	0.04	2.63 %
8	1.52	0.00	0.00 %
9	1.55	0.03	1.97 %
10	1.50	-0.02	- 1.31 %
11	1.52	0.00	0.00 %
12	1.47	-0.05	- 3.28 %
13	1.51	-0.01	-0.65%
14	1.49	- 0.03	- 1.97 %
15	1.52	0.00	0.00 %
16	1.50	- 0.02	- 1.31 %
17	1.48	- 0.04	- 2.63 %
18	1.53	0.01	0.65 %
19	1.54	0.02	1.31 %
20	1.53	0.01	0.65 %
Total Weight	30.38g		
Average Weight	1.51 g		

Table 3: Hardness Study of Curcumin Suppository.

Parameter	Pressure in Kg/cm^2	Average Pressure in Kg/cm^2
Hardness Test	5.5	6.5 kg/cm^2
	6	
	6	
	5	
	5.5	
	5	

Table 4: Dissolution Study of Curcumin Suppository.

S.N.	Sample	Time interval(minute)	Absorbance
1	Sample 1	10	0.298
2	Sample 2	20	0.329
3	Sample 3	30	0.353
4	Sample 4	40	0.371
5	Sample 5	50	0.380
6	Sample 6	60	0.519

CONCLUSION

We made the yellow-orange, smooth, and glossy curcumin suppositories using the glycerol and gelatine fusion technique. Gelatine effectively served as an adjuvant, as glycerol alone was unable to provide the necessary physical qualities in the suppositories. We assessed each formulation using a range of parametric and non-parametric methods. We observed a uniform drug distribution in the formulation, with content uniformity ranging from 96.25 ±0.5 to 98.57 ±0.5;

diameter of 1 ±0.1cm; length of 2.5 ±0.1cm; hardness of 5 kg/cm2 to 5.5 kg/cm2; and weight uniformity of 1.47 to 1.56g. The average disintegration time of the samples is 32 minutes. Based on the dissolution result, we can infer that the curcumin exhibits first-order release kinetics, with gelatine showing a higher rate of dissolution at the 60-minute mark.

ACKNOWLEDGMENTS

We acknowledge the recognition to the Principal of the institution for his support in carrying out this research. This work was emotionally supported by the family members and professionally supported by Pharmaceutical Chemistry and Pharmaceutics Department of our college laboratory Staff. Finally much thankful to all whom, I could not mention here for area of work of compiling process.

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