Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/44cy6v31

DEVELOPMENT OF SR METFORMIN HCL TABLET USING FLAX AND CHIA SEED MUCILAGE

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Abstract
Aim: This work is to Development of SR Metformin HCl tablet using flax and chia seed mucilage.
Methods: This present study was to design of SR Metformin HCl tablets using flax and chia seed mucilage. The mucilage was extracted from flax and chia seeds via hot extraction method. Metformin HCl tablets were prepared using mucilage by wet granulation method and then optimized SR action by in vitro studies.
Results: The formulated tablets were evaluated for physical characteristics like weights variations, hardness, friability, drug content and drug release that fulfilled all the official requirements of tablet dosage form. The release rate of SR tablets were carried out in HCl (pH1.2) followed by phosphate buffer (pH 6.8). In-vitro release study shows that the mucilage based SR formulations (TS9) exhibited the highest correlation value (r^2) for Higuchi kinetic model.
Conclusion: In vitro studies indicated that the formulation showed better sustained release action.

Keywords: Chia seeds, Flex seeds, Metfomin HCl, MCC, Magnesium stearate, in-vitro studies.

1. Introduction

A class of metabolic disorders known as diabetes is defined by elevated blood sugar levels brought on by deficiencies in either insulin production, insulin action, or both. Diabetes's chronic hyperglycemia is linked to long-term harm, malfunction, and organ failure particularly to the kidneys, eyes, heart, nerves, and blood vessels [1]. The etiology of diabetes involves multiple pathogenic mechanisms. These include anomalies that lead to resistance to the action of insulin and autoimmune destruction of the pancreatic B-cells, which results in an insulin shortage [2]. Type- 1 diabetes (cell destruction, usually leading to absolute insulin deficiency) [3] & Type- 2 diabetes (ranging from predominantly insulin resistance with relative insulin deficiency to predominantly an insulin secretary defect with insulin resistance) [4]. Now a day's herbal drugs mainly used to cure diseases. Globally, the essential yearly herbs have become increasingly popular. Chia seeds (*Salvia hispanica* L) family Lamiaceae and Flaxseed (*Linum usitatissimum*), also known as common flax or linseed, family Linaceae. it is also known as “Alsi”, “Jawas”, and “Aksebija”. Herbal medicines are useful for a broad range of therapeutic purposes and appear to have fewer negative side effects [5]. One of the best seed products for mechanical, fiber, bolstering and nutrition. Both have notable

amounts of short-chain ω− 3 fatty acids and comparable healthy qualities. The particular instance is a yellow flaxseed known as Solin (exchange name Linola), which has an unusual content of ω− 3 fatty acids and a unique fatty acid composition. Flax and chia seeds lowering the ability of degenerative (diabetes, cholesterol & obesity) and also has prebiotic property [6].

2.Materials and methods

2.1 Materials

Flax seeds and Chia seeds were procured from local market, Panchkula, Haryana India. Metformin HCl standard was kindly supplied as a gift sample (park pharmaceuticals, Baddi). MCC Talc and Magnesium stearate was purchased from BASF Corporation USA.

2.2 Procedure for Extraction of Flax and chia seeds Mucilage

Flax and chia seeds were collected from an authentic source. Both seeds were grinded to a coarse powder by mixer grinder. Soxhlet extraction was done at 60 C for 7-8 hours for both flax and chia seeds by using chloroform as a common solvent. The filtrates (Chloroform extract) obtained from both seeds were evaporated using rota evaporator. The Mucilagenous concentrates were obtained, which were kept in vacuum desiccators[7].

2.3 Formulation of SR Metformin HCl tablet

The SR tablet formulation of Metformin HCl was prepared by wet granulation method were shown in Table 1. Initially, the semisolid dough was prepared from the extracted mucilage of flex and chia seed with the minimum amount of hot water (50ºC), then Metformin HCl and MCC were mixed intimately with it. The formed mass was then sieved through #18 to obtain granules which were dried at 60 ºC for 20 min and further passed through # 18 mesh. These prepared granules were lubricated with purified talc and magnesium stearate and then compressed [8].

Table 1. Composition of SR Metformin HCl tablet Batches

Formulationcode	Drug (mg)	Flex seed mucilage (mg)	Chia seed mucilage (mg)	Magnesium Stearate (mg)	Talc (mg)	MCC (mg)	Total (mg)
MT1	500	70	60.00	10	10	350.00	1000
MT2	500	70	-	10	10	410.00	1000
MT3	500	-	60.00	10	10	410.00	1000

2.4 Evaluation of granules

The prepared granules were evaluated for angle of repose, loose bulk density (LBD), tapped bulk density (TBD), compressibility index and drug content. The angle of repose was determined by funnel method. By using cylinder method, bulk density and tapped density were measured. Carr's index (CI) was used to evaluated the rate at which the powder was packed down. Hausner's ratio was used to predict the flow properties of prepared granules. It ranges from 1.12 to 1.25, was thought to indicate good flow properties. The LOD of wet granules was evaluated using an electronic moisture balance and calculated the weight loss during drying [9, 10].

2.5 Evaluation of tablets

The formulated tablets were evaluated for weight variation, hardness, thickness, friability and drug content. The weight variation test was performed according to the official method by comparing individual weights with that of their average weight. The hardness of the tablets was tested using a Monsanto hardness tester (Keshav Int. Pvt Ltd.India). The Friability of the tablets was determined in a Roche friabilator (Keshav Int.Pvt.Ltd.India). The thickness of the tablets was measured by a vernier caliper. Drug content was determined using UV is spectrophotometer (Shimadzu India) [11, 12].

2.6 In vitro dissolution study

The dissolution study of Metformin HCl from the prepared batches of tablets was conducted in USP type I dissolution apparatus in triplicate using three tablets from each batch. Dissolution media comprised of 900 ml 0.1N HCl and phosphate buffer (pH 6.8) for 24 hrs, maintained at 37.0 ± 0.5 °C for100 rpm. The release rate from the tablets were conducted in dissolution medium of 0.1NHCl for 2hrs and thereafter in phosphate buffer pH 6.8 for 24hrs. An aliquot of 5 ml sample was withdrawn and replaced with another 5 ml of fresh dissolutionmedium at various time intervals. The % drug release in the sample was determined by measuring the absorbance at 232nm using UV–Visible Spectrophotometer [13,14].

3. Results & Discussion

Evaluation of granules

The prepared granules were evaluated for pre-compression parameters such as angle of repose, bulk density, tapped density, carr's index, hausner's ratio and LOD were shown in Table 2. The angle of repose was found to be in the range 20.49±0.56 to 25.18±0.21. Bulk density was found to be between 0.34±0.05 to 0.44±0.03gm/cm^3 and tapped density between 0.38±0.07 to 0.50±0.01gm/cm^3 for all formulations. Hausner's ratio was found in a range of 1.08±0.01 to 1.12±0.01, Carr's index was found in a range of 7.77±1.18 to 11.28±1.40 and LOD was found in a range of 1.03±0.01 to 2.12±0.02. All the batches have shown good to excellent flow properties. Hence, tablets were prepared with these granules in combination by the wet granulation method.

Table 2: Precompression Parameters of SR Metformin HCl tablet Batches

Formulation Code	Angle of repose (θ)	Bulk density (g/cm^3)	Tap density (g/cm3)	Hausner's Ratio (Mean ±SD)	Carr's Index (%)(Mean±SD)	LOD
MT1	20.49±0.56	0.44±0.03	0.50±0.01	1.12±0.01	11.28±1.40	2.12±0.02
MT2	25.02±0.31	0.34±0.05	0.38±0.07	1.09±0.02	8.92±2.22	1.03±0.01
MT3	25.18±0.21	0.37±0.07	0.40±0.01	1.08±0.01	7.77±1.18	1.05±0.01

Evaluation of tablet

The formulated tablet were evaluated by post-compression parameters such as weight variation, thickness, hardness, friability, swelling index and drug content that were shown in Table 3. Weight variation was found to be in the range between 994.4±2.05to 1000.6±4.9mg. The thickness of all the batches was found to be between 6.04±0.03mm to 6.09±0.03mm.The hardness of the tablet was found to be in the range of 5.52±0.06to 5.72±0.06. The % friability was found to be 0.51±0.16 to 0.64±0.12 that below 1% indicating the friability is within the prescribed limits. The equilibrium water uptake was observed from the ranges 91.40±0.04% to 124.53±0.01% in phosphate buffer, which was increased with an increasing amount of grafted fenugreek gum, it may be due to presence of different hydrophilic groups. It shows that metformin HCl containing grafted fenugreek gum exhibited the maximum swelling ratio, indicating a high degree of swelling due to water uptake. The percent drug content in tablet batches was found to be within the range of 97.00±0.70 to 98.75±0.22 indicated uniformity of mixing.

Table 3: Postcompression Parameters of SR Metformin HCl tablet Batches

Sr. no.	Formulation Code	Weight variation (mg)	Thickness (mm)	Hardness (kg/cm^2)	%Friability	Swelling Index 0.1NHCl Content (pH1.2)	Swelling Index Phosphate buffer (pH6.8) 24 h4 h	% Drug
1	MT1	1000.6±4.9	6.04±0.03	5.52±0.06	0.53±0.30	19.56±0.02	91.40±0.04	97.00±0.70
2	MT2	996.6±3.42	6.06±0.02	5.64±0.12	0.64±0.12	26.79±0.01	124.53±0.01	98.75±0.22
3	MT3	994.4±2.05	6.09±0.03	5.72±0.06	0.51±0.16	29.36±0.03	123.22±0.07	97.23±0.76

3.7 In vitro release study

In vitro drug release study of different tablet batches were shown in Table 4.

Dissolution Media	Time (h)	%drug release MT1	%drug release MT2	%drug release MT3
0.1N HCl	0.25	1.84±0.05	1.32±0.07	0.86±0.10
	0.5	8.53±0.01	5.37±0.03	5.41±0.05
	1	11.84±0.01	10.25±0.01	13.24±0.06
	1.5	14.46±0.06	15.94±0.07	21.23±0.02
	2	20.67±0.06	20.46±0.03	32.05±0.34
pH6.8 Phosphate Buffer	3	25.57±0.35	25.57±0.41	40.35±0.20
	4	36.79±0.43	31.79±0.60	45.21±0.30
	5	45.56±0.62	40.56±0.26	50.49±0.11
	6	49.51±0.10	46.51±0.26	54.24±0.28
	8	56.56±0.03	51.56±0.06	64.75±0.68
	10	60.27±0.14	58.27±0.71	68.75±0.33
	24	95.73±0.64	87.73±0.69	81.15±0.48

MT1 batch has shown maximum release up to 95.73±0.64% within 24 hrs as compared to other batches. MT1 gives a prolonged release in a controlled fashion than in comparison to other batches. The formulation batch T2 shows sustained release properties by prolonged release more than 24hrs uniformly.

4. Conclusion

In the present work, Extracted the mucilage of flex and chia seeds. After that designed the SR tablet of Metformin HCl using these mucilage. The selected tablet formulation (MT1) were exhibited a better-sustained release action.

Declaration of Competing Interest

The author is responsible for the content and writing of this article.

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