Available online on 15.06.2019 at http://jddtonline.info

Journal of Drug Delivery and Therapeutics

Open Access to Pharmaceutical and Medical Research

© 2011-18, publisher and licensee JDDT, This is an Open Access article which permits unrestricted non-commercial use, provided the original work is properly cited

Open Access Research Article

Design, Formulation and Evaluation of Fast Disintegrating Tablets of Glipizide

Dillip Kumar Brahma*, Neeraj Sharma

Department of Pharmacy, Sri Satya Sai University of Technology & Medical Sciences, Sehore-466001, Madhya Pradesh, India

ABSTRACT

Diabetes mellitus is metabolic disorder it is caused by an absolute or relative lack of insulin that, among other consequences, to increase in plasma glucose concentration associated with change hyperglycemia and disturbance of lipid metabolism, carbohydrate metabolism, also protein metabolism. Absolute lack of insulin called as Type 1 diabetes mellitus also called as juvenile diabetes. The condition caused by a lesion in the beta cells of the pancreas. Type 2 diabetes is a long term metabolic disorder that characterized by high blood sugar , insulin resistance ,and relative lack of insulin/ The prepared tablets were adequately hard to withstand pressure the hardness ranged from (2.91-3.67). The friability from the tablets was less which represent less loss of free particles. The weight variation and wetting were within limits. The dissolution of prepared tablets was relatively fast.

Keywords: *Diabetes mellitus*, glipizide, Fast Disintegrating Tablets.

Article Info: Received 20 April 2019; Review Completed 22 May 2019; Accepted 25 May 2019; Available online 15 June 2019

Cite this article as:

Brahma DK, Sharma N, Design, Formulation and Evaluation of Fast Disintegrating Tablets of Glipizide, Journal of Drug Delivery and Therapeutics. 2019; 9(3-s):100-103 **http://dx.doi.org/10.22270/jddt.v9i3-s.2806**

***Address for Correspondence:**

Dillip Kumar Brahma, Department of Pharmacy, Sri Satya Sai University of Technology & Medical Sciences, Sehore-466001, Madhya Pradesh, India

INTRODUCTION

Diabetes mellitus is known as blood-sugar disease. The pancreas fails to perform its appropriate function to stimulate insulin production in diabetic patients. The prevalence of type 2 *diabetes mellitus* (T_2DM) has increased dramatically during recent decades and now it is a serious global health burden. According to the International Diabetes Federation 2015 report, the ratio of diabetic patients in the world is one out of eleven adults. *Diabetes mellitus* and its related complications are major causes of death in various countries. *Diabetes mellitus* (DM) is a metabolic disorder characterised by hyperglycaemia and interruption of the metabolism of protein, carbohydrate and fat. It may be associated with distinctive symptoms, such as polyuria (frequent urination), polydipsia (increased thirst) and polyphagia (increased hunger)[1]. DM is an important public health concern that affects more than 170 million individuals worldwide. It is expected that the number of people suffering from diabetes in the UK will reach approximately 5 million, or almost 10% of the population, by 2025 and it is one of the leading causes of death worldwide. Diabetes is a multi-organ disease independent of age, race and gender. A number of pathogenic actions are involved in the progress of diabetes, including destruction of the beta cells of the pancreas, which leads to insulin deficiency. Some of the processes can cause resistance to insulin, leading to increased plasma glucose levels and abnormalities of carbohydrate, fat and protein metabolism[2]. Diabetes is classified into four groups: type 1, type 2, gestational and maturity onset diabetes of the young (MODY). Type 2 diabetes is a group of progressive disorders characterised by high blood glucose levels caused by a lack of insulin activity which can arise from a combination of impaired insulin secretion and impaired response to insulin in key tissues and organs, known as insulin resistance[3]. One consequence is that gluconeogenesis in the liver is no longer inhibited by insulin, and thus increases. Insulin resistance means that the body is unable to use insulin efficiently, because target tissues become unresponsive to insulin. Type-2 diabetes develops most often in middle-aged and older adults, but increasingly is appearing in children, teenagers and young adults[4]. It accounts for about 90% of cases of diabetes. Patients with this type of diabetes may not require insulin to survive. Type 2 diabetes is often a result of excess body weight and physical inactivity in genetically predisposed individuals and is the most common type[5].

Glipizide, a second-generation sulfonylurea, is used with diet to lower blood glucose in patients with diabetes mellitus type II. The primary mode of action of glipizide in

experimental animals appears to be the stimulation of insulin secretion from the beta cells of pancreatic islet tissue and is thus dependent on functioning beta cells in the pancreatic islets. In humans glipizide appears to lower the blood glucose acutely by stimulating the release of insulin from the pancreas, an effect dependent upon functioning beta cells in the pancreatic islets. In man, stimulation of insulin secretion by glipizide in response to a meal is undoubtedly of major importance. Fasting insulin levels are not elevated even on long-term glipizide administration, but the postprandial insulin response continues to be enhanced after at least 6 months of treatment.

Some patients fail to respond initially, or gradually lose their responsiveness to sulfonylurea drugs, including glipizide. For use as an adjunct to diet for the control of hyperglycemia[6–8] and its associated symptomatology in patients with non-insulin-dependent diabetes mellitus (NIDDM; type II), formerly known as maturity-onset diabetes, after an adequate trial of dietary therapy has proved unsatisfactory. The present work was aimed to formulate and evaluate fast dissolving tablets of glipizide.

MATERIALS AND METHODS

Drug and Chemicals

Glipizide was received as a gift sample from Ipca Laboratories Ltd, Ratlam and other excipients such as talc, sodium starch glycolate, lactose were obtained from the CDH, Mumbai.

Method of Preparation

Glipizide was mixed with sodium starch glycolate and lactose, talc was added. The blend was mixed properly and sieved (Table 1). The blend was compressed to prepare tablets

Table 1: Composition of Glipizide fast dissolving tablet Ingredients

Excipients	F1	F2	F3	F4	F5
Glipizide	5	5	5	5	5
Croscarmelose	2	5	2	5	0
Sodium starch glycolate	3	3	6	6	0
Lactose	60	60	60	60	60
MCC	30	30	30	30	30
Magnesium stearate	5	5	5	5	5
Talc	3	3	3	3	3

Evaluation of Formulated Tablets

Micromeretics

- **Angle of Repose**

Angle of repose was determined using fixed funnel method. The blend was poured through a funnel that can be raised vertically until a maximum cone height (h) was obtained. Radius of the heap (r) was measured and the angle of repose (ɵ) was calculated using the formula[9].

$\theta = \tan^{-1}(h / r)$

- **Bulk Density**

Bulk density was determined by pouring the blend into a graduated cylinder. The bulk volume (V) and weight of the powder (M) was determined. The bulk density [9] was calculated by using the below mentioned formula,

$$\text{Bulk density} = \frac{\text{Mass of Granules}}{\text{Volume}}$$

- **Tapped Density**

The measuring cylinder containing a known mass of blend was tapped for a fixed time. The minimum volume (Vt) occupied in the cylinder and the weight (M) of the blend was measured. The tapped density [9] was calculated using the following formula

$$\text{Tapped density} = \frac{\text{Weight of Blend}}{\text{Volume occupied in cylinder}}$$

- **Compressibility Index**

The simplest way for measurement of free flow of powder is compressibility , a indication of the ease with which a material can be induced to flow is given by compressibility index (I) [10]which is calculated as follows,

$$I = \frac{Vo - Vt}{Vbx}$$

Here, V_0 is bulk volume and V_t is tapped volume. The value below 15% indicates a powder with usually give rise to good flow characteristics, whereas above 25% indicate poor flow ability.

- **Hausner's Ratio**

Hausner's ratio is an indirect index of ease of powder flow[10]. It is calculated by the following formula,

$$\text{Hausner ratio} = \frac{\text{Tapped density}}{\text{Bulk density}}$$

Lower Hausner's ratio (<1.25) indicates better flow properties than higher ones (>1.25).

Thickness

Thickness of tablet was determined by using vernier calliper (Mitutoya, Model CD-6 CS, Japan).

Hardness

The crushing strength of the tablets was measured using a Monsanto hardness tester (Sheetal Scientific Industries, Mumbai, India). Three tablets from each formulation batch were tested randomly [11] and the average reading noted.

Friability

Twenty tablets were weighed and placed in a Roche friabilator (Electrolab, India). Twenty reweighed tablets were rotated at 25 rpm for 4 min. The tablets were then dedusted and reweighed and the percentage of weight loss was calculated. The percentage friability of the tablets were measured [11] as per the following formula,

$$\text{Percentage friability} = \frac{\text{Initial weight} - \text{Final weight}}{\text{Initial weight}} \times 100$$

Weight Variation

Randomly, twenty tablets were selected after compression and the mean weight was determined[11]. None of the tablets deviated from the average weight by more than ±7.5%.

Wetting Time

A piece of circular tissue paper (8cm) folded twice was placed in a Petri dish (Internal Diameter = 9 cm) containing 10 ml of buffer solution simulating saliva pH 6.8. A tablet was placed on the paper and the time taken for complete wetting was noted. Three tablets from each formulation were randomly selected and the average wetting time was noted [12]. The results are tabulated in Table 2.

In Vitro Dispersion Time

In vitro dispersion time of prepared tablet was done by dropping the tablet in 10 ml measuring cylinder containing 6 ml of simulated salivary fluid (pH 6.8). Time required for complete dispersion of tablet was measured [13].

Dissolution Study

In vitro release of Glipizide from tablets was monitored by using 900 ml of simulated intestinal fluid, SIF (USP phosphate buffer solution, pH 7.4) at 37±0.5°C and 50 rpm using programmable dissolution tester [Paddle type, model TDT-08L, Electrolab, (USP), India]. 5 ml Aliquots were withdrawn at one minute time intervals and were replenished immediately with the same volume of fresh buffer medium. Aliquots, following suitable dilutions, were assayed spectrophotometrically (UV-1700, Shimadzu,Japan) at 378 nm.

RESULTS & DISCUSSION

Five formulations of glipizide were prepared with different concentration of the four individual Superdisintegrants: Croscarmelose and Sodium starch glycolate. For each formulation, blend of drug and excipients were prepared and evaluated for various parameters as explained earlier. The powder blend was compressed using direct compression technique. Bulk density was found in the range of 0.45 – 0.43 g/cm^3 and the tapped density between 0.35 – 0.38 g/cm^3. By using these two density data, Hausner's ratio and compressibility index was calculated. The compressibility index was found between 13.27 and 20.32 and the compressibility correlation data indicated a fairly good flowability of the powder blend. The good flowability of the powder blend was also evidenced with angle of repose (range of 20.12 –25.97), which is below 40º indicating good flowability. Micromeretic results of the all batches were shown in Table 2.

Table 2: Characterization of Glipizide Tablets

Parameters	F1	F2	F3	F4	F5
Hardness (kg/cm2)	3.01±0.24	3.24±0.56	2.91±0.22	3.11±0.54	3.67±0.12
Friability (%)	0.744± 0.024	0.647±0.062	0.645±0.053	0.621±0.042	0.589±0.054
Weight variation (mg)	100±3	99±2	101±3	101±1	105±1
Thickness (mm)	3.51±0.013	3.44±0.075	3.67±0.045	3.45±0.046	3.53±0.041
Wetting time (s)	16.25±2.5	15.3±1.5	13.6±2.2	14.1±2.0	14.4±1.5
In-vitro dispersion time (s)	30.32±2.51	28.14±1.14	26.24±2.24	25.74±3.27	24.84±2.25

Results are expressed as mean±SD (n=3)

The prepared tablets were adequately hard to withstand pressure the hardness ranged from (2.91-3.67). The friability from the tablets was less which represent less loss of free particles. The weight variation and wetting were within limits.

Table 3: Micromeretics of Glipizide Blend

Formulation Code	Bulk density (gm/ml)	Tapped density (gm/ml)	Angle of repose (θ)	Percentage compressibility	Hausner's Ratio
F 1	0.45	0.38	25.97	20.32	1.15
F 2	0.45	0.38	24.84	18.24	1.21
F 3	0.44	0.37	25.34	16.52	1.23
F 4	0.43	0.36	22.55	14.23	1.24
F 5	0.43	0.35	20.12	13.27	1.26

Results are expressed as mean±SD (n=3)

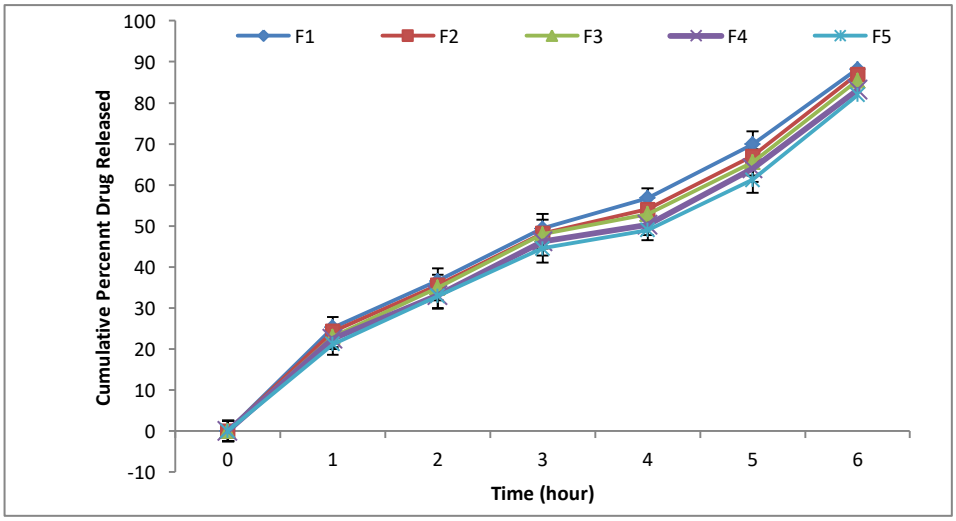

Figure 1: Dissolution studies of prepared tablets (n=3)
Results are expressed as mean±SD

The dissolution of prepared tablets was relatively fast. These results indicated that dissolution parameter values of croscarmellose sodium and sodium starch glycolate [14] containing tablets are in consistent with the disintegration time values observed.

CONCLUSION

In the light of the results, our study indicates that Glipizide tablets may have good antidiabetic activity. The immediate release effect of drug may be responsible for rapid reduction of blood glucose levels.

REFERENCES

1. Association AD. Diagnosis and classification of diabetes mellitus. Diabetes Care 2010;33(Supplement 1):S62–9.
2. Alberti KGMM, Zimmet PZ ft. Definition, diagnosis and classification of diabetes mellitus and its complications. Part 1: diagnosis and classification of diabetes mellitus. Provisional report of a WHO consultation. Diabet Med 1998; 15(7):539–53.
3. Tuomilehto J, Lindström J, Eriksson JG, Valle TT, Hämäläinen H, Ilanne-Parikka P, et al. Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. N Engl J Med 2001; 344(18):1343–50.
4. Ganeshpurkar A, Kohli S, Rai G. Antidiabetic potential of polysaccharides from the white oyster culinary-medicinal mushroom Pleurotus florida (higher Basidiomycetes). Int J Med Mushrooms 2014; 16(3):207–17.
5. Hu FB, Manson JE, Stampfer MJ, Colditz G, Liu S, Solomon CG, et al. Diet, lifestyle, and the risk of type 2 diabetes mellitus in women. N Engl J Med 2001; 345(11):790–7.
6. Ganeshpurkar, A, Saluja A. The Pharmacological Potential of Rutin. Saudi Pharm J 2016;
7. Ganeshpurkar A, Rai G, Jain A. Medicinal mushrooms: Towards a new horizon. Pharmacogn Rev 2010; 4(8):127–35.
8. Bhadoriya SS, Ganeshpurkar A, Bhadoriya RPS, Sahu SK, Patel JR. Antidiabetic potential of polyphenolic-rich fraction of Tamarindus indica seed coat in alloxan-induced diabetic rats. J Basic Clin Physiol Pharmacol 2018; 29(1):37–45.
9. Bagster RHDF, Crooks MJ. Flow studies on directly compressible tablet vehicles. Drug Dev Ind Pharm 1977;3(5):475–87.
10. Fassihi AR, Kanfer I. Effect of compressibility and powder flow properties on tablet weight variation. Drug Dev Ind Pharm 1986; 12(11–13):1947–66.
11. Seitz JA, Flessland GM. Evaluation of the physical properties of compressed tablets I: Tablet hardness and friability. J Pharm Sci 1965; 54(9):1353–7.
12. Bi Y, Sunada H, Yonezawa Y, Danjo K, Otsuka A, IIDA K. Preparation and evaluation of a compressed tablet rapidly disintegrating in the oral cavity. Chem Pharm Bull 1996; 44(11):2121–7.
13. Swamy P V, Areefulla SH, Shirs SB, Smitha G, Prashanth B. Orodispersible tablets of meloxicam using disintegrant blends for improved efficacy. Indian J Pharm Sci 2007; 69(6):836.
14. Sharma D. Formulation development and evaluation of fast disintegrating tablets of salbutamol sulphate for respiratory disorders. ISRN Pharm 2013; 13:67–75.