Preparation of Fast Dissolving Tablets Using Natural Super Disintegrant

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ABSTRACT
The main objective of preparing of fast dissolving tablets of glipizide to dissolve rapidly to show great bio availability can be done by using natural superdisintegrant in case of synthetic superdisintegrant. The formulation was prepared by direct compression using natural superdisintegrant i.e. isolated mucilage of Plantago ovata. Initially dissolution and disintegration test were carried to know the disintegration and dissolution of drug in stomach pH. The absorbance of drug by using U.V spectroscopy to know the absorbance of drug. Thus superdisintegrant along with their role in tablet disintegration and drug release, which are being used in the formulation to provide the safer, effective drug delivery with patient compliance.

KEYWORDS: fast dissolving tablet, isolate mucilage of Plantago ovate.

INTRODUCTION
The tablet is the most widely used dosage form because of its convenience in terms of self-administration, compactness and ease in manufacturing. However, geriatric and paediatric patients experience difficulty in swallowing conventional tablets, which leads to poor patient compliance. To overcome these problems, scientists have developed innovative drug delivery systems known as Fast dissolving tablets (FDT). These are novel types of tablets that disintegrate/disperse/dissolve in saliva. The target populations for these oral disintegrating dosage forms have generally been paediatric, geriatric, and bedridden or develop mentally disabled patients who have difficulty in swallowing (Dysphasia). Patients with persistent nausea, sudden episodes of allergic attacks or coughing, who are travelling, or who have
little or no access to water are also good candidates for FDTs. The benefits in terms of patient compliance, rapid onset of action, increased bioavailability and good stability make these tablets popular as a dosage form of choice in the current market. Some drugs are in such cases bioavailability of drug is significantly greater than those observed from conventional tablet dosage form. The basic approach used in the development of the FDTs is the use of superdistintegrant. Many approaches have been developed to manufacture FDTs. These include vacuum drying direct compression, lyophilisation and molding. The direct compression method is inexpensive and convenient for producing tablets of sufficient mechanical strength 5, 6. Glipizide is an oral rapid- and short-acting anti-diabetic medication from the sulfonylurea class. It is classified as a second-generation sulfonylurea, which means that it undergoes enterohepatic circulation. Second-generation sulfonylureas are both more potent and have shorter half-lives than the first-generation sulfonylureas.

MATERIALS AND METHODS

Materials
Glipizide, Plantago ovata seeds, microcrystalline cellulose, lactose, magnesium stearate, talc were gifted by our college i.e., Chalapathi institute of pharmaceutical sciences.

Isolation of Mucilage of Plantago ovata
The seeds of Plantago ovata were soaked in distilled water for 48 hrs and then boiled for few minutes for complete release of mucilage into water. The material was squeezed through muslin cloth for filtering and separating out the marc. Then, an equal volume of acetone was added to the filtrate so as to precipitate the mucilage. The separated mucilage was dried in oven at temperature less than 60°C, powdered, sieved (#80) and stored in a desiccators until use.

FORMULATION

Tab1e1: Tablet formulation of Glibenclamide (GP) FDT containing different ingredients.

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Quantity taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glipizide</td>
<td>80mg</td>
</tr>
<tr>
<td>Plantago mucilage</td>
<td>50mg</td>
</tr>
<tr>
<td>Lactose</td>
<td>66mg</td>
</tr>
<tr>
<td>Magnesium stearate</td>
<td>2mg</td>
</tr>
<tr>
<td>Talc</td>
<td>2mg</td>
</tr>
<tr>
<td>Total</td>
<td>200mg</td>
</tr>
</tbody>
</table>
Compression of tablets
All ingredients were triturated individually in a mortar and passed through #80 (Table 1). Then required quantity of all ingredients were weighed for a batch size of 100 tablets and mixed uniformly in a mortar except magnesium stearate. Finally magnesium stearate was added as lubricant. This uniformly mixed blend was compressed in to tablets containing 30 mg drug using rotary tablet machine by direct compression method. Total weight of tablet was kept to be 200mg.

Evaluation of Tablets

**Hardness** - Hardness or tablet crushing strength (Fc), the force required to break a tablet in a diametric compression, was measured using Pfizer Tablet Hardness Tester.

**Friability test** - Friability of tablets was determined using Roche Friabilator. This device subjects the tablets to the combined effect of abrasion and shock in a plastic chamber revolving at 25 rpm and dropping the tablets at a height of 6 inches at each revolution. Pre-weighed sample of tablets was placed in a friabilator and the tablets were subjected to 100 revolutions. Tablets were then dusted using a soft muslin cloth and reweighed.

**Friability (F) = (1- W_o / W) x 100**
Where,
W_o = weight of the tablets before the test.
W = weight of the tablet after the test.

**Water absorption capacity**
Water absorption ratio was determined by the following ratio

**R = 100 x W_b / W_a**
Where,
W_b = Weight of tablet before water absorption
W_a =Weight of tablet after water absorption

**Wetting time** A piece of tissue paper folded twice was placed in a small Petri dish containing 6 ml of water. A tablet was put on the paper and the time required for complete wetting was measured.

**In vitro disintegration time** Tablets were added to 10 ml of Sorenson’s buffer solution of pH 6.8 at 37 ± 0.5°C. Time required for disintegration of the tablets was noted.
In vitro dissolution studies Dissolution studies were carried out by USP-II dissolution apparatus. The tablet was taken from each formulation to carry out the dissolution study in the pH 6.2 buffer solution as dissolution medium (pH of saliva).

Swelling index It is the volume in millilitres that is occupied by 1 gm of drug or any adhering mucilage after it has swollen in an aqueous liquid for 4 h. swelling index was calculated from mean readings of three determinations.

Angle of repose Angle of repose was determined by using funnel method. The accurately weighed blend was taken in a funnel. The height of the funnel was adjusted in such a way that the tip of the funnel just touches the apex of the heap of blend. The drug (as solid dispersion) -excipients blend was allowed to flow through the funnel freely on to the surface. The diameter of the powder cone was measured and angle of repose was calculated using the following equation. \( \tan \theta = \frac{h}{r} \) Where, \( h \) and \( r \) are the height and radius of the powder.

Bulk density apparent bulk density was determined by pouring a weighed quantity of blend into graduated cylinder and measuring the volume and weight. BD = Weight of the powder / Volume of the packing.

Tapped Density It was determined by placing a graduated cylinder, containing a known mass of drug-excipients blend. The cylinder was allowed to fall under its own weight onto a hard surface from the height of 10cm at 2- second intervals. The tapping was continued until no further change in volume was noted. TBD =Weight of the powder / volume of the tapped packing.

Compressibility Index the Compressibility Index of the blends was determined by Carr’s compressibility index.
Carr’s compressibility index (%) = \( \frac{[(\text{TBD-\text{LBD}}) \times 100]}{\text{TBD}} \)
A similar index has been defined by Hausner’s Hauser’s ratio = Tapped density/ poured density

RESULTS AND DISCUSSION
In the present study, glibenclamide fast dissolving tablets were prepared by using natural superdistintegrant such as isolated mucilage of Plantago ovata. IR spectroscopic studies revealed that drug was compatible with all the excipients as shown in Figure 1a, 1b and 1c. The natural superdistintegrant were compared with the standard formulation containing drug
and excipients with microcrystalline cellulose alone and the results were found to be not promising for the fast dissolving tablets.

Figure 1a- IR spectroscopy of Glipizide

![Figure 1a- IR spectroscopy of Glipizide](image)

Figure 1b- FT-IR Spectra of Final Tablet.

![Figure 1b- FT-IR Spectra of Final Tablet](image)

Figure 1c- superdistintegrant

![Figure 1c- superdistintegrant](image)

The hardness of the tablets was found to be between 3.21±0.05 to 3.35±0.065 kg/cm² and friability was found to be below 1% indicating good mechanical resistance as shown in Table
2. The drug content was found to be optimum in all the cases. The blend of the optimized formulation containing glibenclamide and Plantago ovata mucilage was evaluated for parameters like angle of repose was found to be 21.80±0.94. Bulk density was found to be 0.629±0.041 g/cm3 and tapped density 0.853 ± 0.004 g/cm3. Hausner’s ratio was found to be 1.35±0.007 as shown in Table 3.

**Table 2: Evaluation of glibenclamide FDT Containing Different Natural Superdistintegrant**

<table>
<thead>
<tr>
<th>parameters</th>
<th>GP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardness (Kg/cm2)</td>
<td>3.21±0.05</td>
</tr>
<tr>
<td>Friability (% w/w)</td>
<td>0.50±0.006</td>
</tr>
<tr>
<td>DT time (sec)</td>
<td>30.23±0.59</td>
</tr>
<tr>
<td>Wetting time (sec)</td>
<td>11.21±0.45</td>
</tr>
<tr>
<td>Dispersion time (sec)</td>
<td>13.25±0.42</td>
</tr>
<tr>
<td>Water absorption ratio (%)</td>
<td>86.11±0.49</td>
</tr>
</tbody>
</table>

**Table 3 - Characterization of Optimized Formulation P4**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Angle of repose (θ)</th>
<th>Bulk density (g/cm3)</th>
<th>Tapped density (g/cm3)</th>
<th>Hausner’s ratio</th>
<th>Compressibility index (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GP</td>
<td>21.80±0.94</td>
<td>0.629±0.041</td>
<td>0.853±0.004</td>
<td>1.35±0.007</td>
<td>25.35±1.012</td>
</tr>
</tbody>
</table>

The most important parameter that needs to be optimized in the development of fast dissolving tablets is the disintegration time of tablets. In the present study disintegration time of all tablets were found in the range of 30.23±0.59 to 85.17±0.74 secs fulfilling the official requirements (3 min) for dispersible tablets as shown in Table 2.

In-vitro drug release studies were done for the glibenclamide fast dissolving tablet. The drug release was found to show maximum drug release with 96.62% in 25 minutes as shown in Table 4 and Figure 2.

**Table 4- In-Vitro Drug Release Study of Glipizide FDT Time**

<table>
<thead>
<tr>
<th>in mins</th>
<th>GP</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>34.02</td>
</tr>
<tr>
<td>10</td>
<td>57.89</td>
</tr>
<tr>
<td>15</td>
<td>73.25</td>
</tr>
<tr>
<td>20</td>
<td>89.52</td>
</tr>
<tr>
<td>25</td>
<td>96.62</td>
</tr>
</tbody>
</table>
This rapid disintegration of the fast dissolving tablets were due to penetration of saliva into the pores of the tablets, which leads to the swelling of super disintegrate to create enough hydrodynamic pressure for quick and complete disintegration of the tablet. Glibenclamide FDT was selected as optimized batch containing Plantago ovata mucilage as superdistintegrant in 25% concentration. It showed less disintegration time of 30.23secs. Mucilage of Plantago ovata showed less disintegration time as comparison to other natural superdistintegrant. The formulation GP was found to be the best, as this formulation showed less disintegration time and possessing good tableting properties. The swelling index for the mucilage of Plantago ovata was found to be 97±2.45% v/v.

CONCLUSION
From the above data, it can be concluded that mucilage of Plantago ovata is having better disintegrant property than other natural superdistintegrantso it gives good bioavailability than other hypoglycaemic formulations.

REFERENCES


