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ORIGINAL ARTICLE **OPEN ACCESS**

Effect of chironji gum on the disintegrant property of Piper longum tablets

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ABSTRACT
The present work is on the fast disintegrating Piper longum tablets to release the active ingredients at a faster rate. The fast disintegrating tablet was prepared using wet granulation method, with natural chironji gum used in combination with gum acacia. The flow property of the granules were much improved from free flowing to excellent flow with the addition of chironji gum. The tablets were well rounded and free from blemishes. The hardness of the tablet (6.8±0.07and 5.2±0.01kg/cm³) increased in leap and bound for the formulation containing chironji gum as compared to formulation containing only gum acacia (3.5 kg/cm³). Friability also showed the similar trends as hardness. The disintegration performed in simulated stomach pH (pH 1.2) showed significantly faster disintegration of the formulations containing chironji gum (10 min 9s, 14 min 9s) as compared to the formulation without chironji gum (34min 11s).
Keywords*: Disintegrant, Chironji gum, Herbal tablet, Hardness*

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INTRODUCTION

A tablet is a solid dosage form that contains an active pharmaceutical ingredient along with a binder, disintegrating agent, lubricant, glidant, flavouring agent, and other ingredients that are compressed into a compact mass and used to deliver the active pharmaceutical ingredient to the body to produce a pharmacological action [1]. For the oral dosage form to deliver its mechanism of action in the body, it should ideally be divided into small particles. The majority of disintegrating agents used to dissolve tablets in biological fluids are synthetic in nature, however nowadays natural products instead. The pharmaceutical industry has produced and used a large number of disintegrating agents in recent years. The three primary types of disintegrants are synthetic, semisynthetic, and natural [2, 3]. There are various natural disintegrants used industries considered GRAS and are preferred over synthetic and semisynthetic variants. Although considered as safe but, these disintegrant are intra-granular in nature as they undergo both wetting and drying during granulation, rendering it ineffective in equivalent load. This problem is prevalent in disintegrants like corn starch which has caused industries to look for newer options in terms of disintegrant in which method of manufacturing will have less effect on its functionality [4]. Chironji gum, a polysaccharide obtained from the bark exudate of *Buchanania lanzan* tree belonging to the family Anacardiaceae, commonly found in the forest covers of Jharkhand, Chhattisgarh and Andhra Pradesh. Chironji gum has been traditionally used in food and pharmaceutical industry as binder, stabilizer, suspending and thickening agents for various products [5]. There have been reports of chironji gum, used as emulsifying agent in adjuvant with ionic gums [6] Although various reports of its application and usage in different industries have been reported, the disintegration efficiency of chironji gum have received less attention among scientists. This study provides clear evidence of chironji gum used as an adjuvant to gum acacia as a dis integrating agent in herbal *Piper longum* tablets.

MATERIAL AND METHODS

Materials

Piper longum leaves were procured from Bixa Botanicals and has been traditionally used to treat and control chronic bronchitis, asthma and other respiratory ailments. Standardized chironji gum was bought from National Institute of Secondary Agriculture, Namkum, India. Other materials like MCC, Acacia, Talc

procured from Nice chemicals and were of analytical grade. Distilled water was used throughout all the processes.

Methods

Preparation and isolation of chironji gum polysaccharide

Dried droplets of the exudates from the bark of chironji tree was scrapped carefully to avoid wooden shrapnel. The droplets were crushed to fine powder and sieved. The sieved powder was boiled for a period of 6h and precipitated with 95% ethanol (in 1:4 ratio). The precipitates were collected by centrifugation for 25 min at 3500 rpm and dried to get pure gum polysaccharide [7].

Formulation of herbal tablets

In this formulation, the dried root powder of *Piper longum* was used as drug to form a tablet dosage form. The formulation was performed by following the wet granulation process and further compression by Kambert mini press tablet punching machine. The ingredients present in the formulation is mentioned in Table 1 [8].

Wet granulation methods

Weigh the drug, binder/disintegrant polymer and microcrystalline cellulose accurately, mix well and triturate by using mortar and pestle. The vehicle, distilled water was added slowly to form a damp mass. Damp mass was transfer through sieve no. 16. Prepared granules are dried at room temperature. The well dried granules mixed with lubricants talc and Magnesium stearate are ready for compression [9].

Table 1: Formulation of *Piper longum* tablets

Sl. No.	Ingredients	Quantity (mg)		
		F1	F2	F2
1.	*Piper longum* root powder	50	50	50
2.	Acacia gum	50	25	15
3.	Chironji gum	0	25	35
4.	Microcrystalline Cellulose	145	145	145
5	Talc	4	4	4
6.	Magnesium Stearate	1	1	1

PREFOMULATION STUDIES

The granules were subjected to preformulation studies before the formulation of tablet

Bulk density

Bulk density was carried out by pouring dried granule in a 10 ml measuring cylinder and calculated by the following formula [10].

Bulk Density = Mass of the granules/Bulk volume of the granules ….1

Tapped Density

Tapped density was carried out by pouring dried granule in a 10 ml measuring cylinder. The measuring cylinder was tapped 100 times and the volume was noted and was calculated by the following formula [10].

Tapped density= Mass of the granules/Tapped volume of the granules ….2

Hausner's Ratio

Hausner's ratio is the ratio of tapped density of granules to bulk density of granules. It is calculated by the following formula [10].

Hausner's ratio= Tapped density/bulk density ……3

Carr's index

Carr's index or compressibility index is determined by the following formula. Table 2 shows the flow property of granules [10].

$$CI = [\rho_{tapped} - \rho_{bulk} / \rho_{tapped}] \times 100 \quad \ldots\ldots 4$$

ρ_{tapped} = Tapped density

ρ_{bulk} = Bulk density

Angle of repose

Angle of repose was determined by using funnel method. The precisely weighed mixture was placed in a funnel. The funnel's height was adjusted so that the tip of the funnel just touches the apex of the heap or head of blend. The drug excipient blend was allowed to freely flow through the funnel and onto the surface [11]. The diameter of the powder cone was measured and angle of repose was calculated using the following equation:

$$\tan\theta = h/r \quad \ldots\ldots 5$$

Where h = height of powder cone formed
r = radius of the powder cone formed

PHYSICAL EVALUATION OF TABLET

General appearance

The general appearance and colour of the tablets were determined visually.

Weight variation test

The average weight was determined by randomly selecting and weighing 20 tablets. Each tablet was also weighed separately. Each case's deviation from the average weight was calculated and expressed as a percentage. Not more than two of the tablets in the sample size tonne deviate from the average weight by a greater percentage, and none deviate by more than double that percentage [12].

Hardness and friability test

The hardness and friability of the tablets were determined using a calibrated hardness tester (Monsanto) and a Roche friabilitor (4 minute at 25 rpm) [13].

Disintegration test

A glass or plastic tube 80-100 mm long with an internal diameter of about 28 mm and an external diameter of 30mm fitted with a rust proof wire gauge disc at the lower end. Two tablets of each F1-F3 were placed in the tube, and the movement was repeated 40 times per minute. The experiment was performed in simulated gastric fluid (pH 1.2). When no particles remain above the gauge and can easily pass through the mesh, the tablets are disintegrated (10 mesh screen) [14].

RESULTS

The formulation prepared by wet granulation method was subjected to pre formulation micromeritic studies. All the evaluated pre formulation parameters are shown in Table 2. Based on the pre-formulation studies, the flow properties of the tablet granules were found to be between excellent and good flow, with F2 formulation showing the best flow properties. The physical parameters of the compressed tablet are presented in Table 3. The compressed tablets were greenish brown in color with smooth surface devoid of visible cracks or blemishes. The hardness of F2 was found to be highest at 6.8 kg/cm^2, while F3 had hardness of 5.2 kg/cm^2 and F1 had 3.5 kg/cm^2 hardness indicating high integrity of the tablet. The weight variation ranged between 0.251±0.02 g, 0.256±0.01 g and 0.261±0.02g for F1, F2 and F3 respectively. Friability of the tablets ranged between 0.88% to 1.12% for all three tablet formulations. The disintegration time for F2 was very low at 10min 09 sec, while for F3 it was 14min 26sec and F1 disintegrated in 34 min 11 sec. Thus these results indicate F2 and F3, which contains chironji gum helps in disintegration of tablet thereby indicating the disintegrant property of chironji gum. This property will help in designing of fast releasing tablets in further researches [15].

Table 2: Preformulation studies of the granules

Sl. No.	Preformulation studies	F1	F2	F3
1.	Bulk Density (g/cc)	0.294±0.03	0.454±0.07	0.385±0.11
2.	Tapped Density (g/cc)	0.333±0.13	0.555±0.17	0.454±0.18
3.	Hausner's ratio	1.22±0.09	1.13±0.06	1.18±0.01
4.	Carr's index	18.19±0.06	11.71±0.04	15.29±0.08
5.	Angle of Repose (^{o})	31.12±0.17	29.058±0.11	30.019±0.17

Table 3: Physical Evaluation of the tablet

Sl. No.	Physical Evaluations	F1	F2	F3
1.	General Appearance	Greenish brown	Greenish brown	Greenish brown
2.	Weight variation (g)	0.251±0.02	0.256±0.01	0.261±0.02
3.	Hardness (kg/cm^3)	3.5±0.03	6.8±0.07	5.2±0.01
4.	Friability (%)	1.12±0.02	0.80±0.02	0.96±0.03
5.	Disintegration (Min)	34 min 11 s	10min 09 s	14min 26s

CONCLUSION

Chironji gum content in the tablets especially F2 formulation containing chironji gum and gum acacia in the ratio of 1:1 demonstrated to affect flow properties, hardness, friability and the time of disintegration. None of the factors of investigation seems to affect the weight variation in the different batches of tablet formulations. As for the disintegration studies performed on all three batches of tablets in a simulated stomach condition (pH 1.2), F2 formulation showed the fastest disintegration (10 min 9s), with F3 (14 min 9s) not far behind as compared to formulation F1 (34 min 11s) indicating the disintegrant property of

chironji gum. Thus this property can be further explored for developing different fast releasing formulations.

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CONFLICT OF INTEREST
None

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