

## Evaluation of *Beilschmiedia* Seed Gum as a Tablet Binder

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***Beilschmiedia* gum derived from the edible seeds of *Beilschmiedia mannii* (family Lauraceae) was evaluated for its binding properties at a concentration range of 0.5-10 % w/w in paracetamol tablets with official gelatin as a control. A comparative analysis showed that the granules bound with *Beilschmiedia* gum were relatively bigger and harder than the ones obtained with gelatin gum. The hardness, disintegration time and dissolution rate increased with increase in concentration of *Beilschmiedia* gum. Tablets containing 5 % w/w of *Beilschmiedia* gum had a binding capacity approximately twice that of gelatin with a dissolution rate of 91 % after 30 min. The results obtained suggest that *Beilschmiedia* gum possesses potential as a commercial binding agent.**

**Keywords:** *Beilschmiedia* gum, gelatin, disintegration, dissolution, hardness.

### INTRODUCTION

The quality and type of binder used has considerable influence on the characteristics of compressed tablets [1]. Excessive concentration or strength of binder will make hard tablets which will not disintegrate easily and cause excessive wear of punches and dies while too low concentration of binder usually results in tablets with capping, lamination and even weight variation.

Natural and synthetic gums are used widely as binders in the formulation of tablets. Locally available gums that have been investigated include *Mucuna* gum [2], *Cissus polpunea* gum, *Caesalpinia pulcherrima* gum [3] and *Khaya* gum [4].

In the present work, *Beilschmiedia* gum known as ɔgbokonisa in Yoruba was studied. *Beilschmiedia mannii* is a plant that thrives well in Nigeria especially in the southern parts of the country in Ogun and Cross River States. It grows very well in marshy areas and usually reaches up to 30-40 ft high and 3 ft in diameter with a spreading crown and straight pole [5]. The bark is brownish green with the inner bark containing a sticky brownish sap. Its leaves are often sub-opposite, oblong-elliptic, acuminate and up to 9×4 inches in size. The leaves have 5-

8 pairs of lateral nerves while the leaf stalk is slender and usually 2-6 inches long. Seeds are reddish-brown and measure about 1.5 inches long [6]. Locally, the seeds are used as a condiment to enrich soup.

### MATERIALS AND METHODS

Paracetamol powder was obtained from May & Baker (Dagenhan, UK). Lactose and corn starch were sourced from B.D.H Chemicals (Poole, UK) while gelatin, magnesium stearate and talc were products of Merck (Darmstadt, Germany).

The tablet disintegration rates were determined using an Apex Disintegration Testing Apparatus (Apex Construction Ltd, Northfleet Gravesent and Dartford, Kent, U.K.). Tablet hardness was determined by measuring the force required to fracture tablets by diametral compression on a manual Ketan hardness tester (Integrated Drive System, PVT Ltd, Ketan Shah, Mumbai, India). Mixing was carried out using a Kenwood planetary mixer (Model PM900, Kenwood Ltd, Havant, U.K.).

### Collection and preparation of *Beilschmiedia* gum

*Beilschmiedia* gum was collected from a local farm in Ijebu-Itele in Ogun State, Nigeria. The

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seeds were sun dried, crushed using a mortar and pestle and pulverized in a blender (Model 857, Chrome white, Osterizer, U.S.A.) to produce the gum powder. The gum powder was sifted (sieve size 150  $\mu$ m) and hydrated in double strength chloroform-water mixture for 5 days with intermittent stirring. The resultant mucilage was screened through a clean calico cloth to remove extraneous materials and undissolved gum.

The pure gum was precipitated from solution with 95 % v/v ethanol in the ratio of 2:3 for gum and 95 % v/v ethanol respectively. The precipitated gum was filtered and washed with diethyl ether and dried in a hot air oven at 40 °C for 24 h.

### Preparation of granules

Fifty gram batches of the basic formulation comprising paracetamol powder (65 % w/w), lactose (25 % w/w) and corn starch (19 % w/w) were dry mixed for about 3 min. The mixture was then moistened with *Beilschmiedia* gum mucilage or gelatin solutions to produce samples containing concentrations of the binding agents in the range 0-12.5 % w/w.

Massing continued for about 5 min after which the wet masses were granulated manually by passing through a mesh screen of 1000  $\mu$ m. The granules were dried on trays in a hot air oven for 24 h at 60 °C, screened through a No. 16 mesh sieve (1000  $\mu$ m) and stored in air-tight containers.

### Preparation of tablets

The granules were compressed in a Carver hydraulic hand press (Model C, Carver Inc., Menomonee Falls, Wisconsin, U.S.A). The die and punches were lubricated with a 10 % w/v dispersion of magnesium stearate in acetone. Formulations (500mg $\pm$ 10mg of paracetamol) were transferred into the die cavity on the lower punch and pressure applied using the upper punch. The pressure was maintained for 1 min and the tablet ejected and stored in air-tight container over silical gel for 24 h to allow for elastic recovery and hardening. The procedure was carried out in triplicate.

### Disintegration and dissolution tests

The disintegration and dissolution tests were carried out according to the USP/NF (2004) specifications [7].

### Hardness test

Five tablets were tested from each of the three batches. The tablets were placed between the anvil ends and a force generated through a coil spring was applied by turning the screw. The average force ( $\text{kgcm}^{-1}$ ) was recorded.

## RESULTS AND DISCUSSIONS

There was a general increase in the mechanical strength of the tablets with increasing binder concentration attributable to the increased strength of inter-particulate bonding and enhanced ability to adequately wet and coat the particles. Furthermore increased concentration may result in the formation of thicker adhesive coats around the particles [8-13]. Tablets produced with *Beilschmiedia* gum were found to be harder at all concentrations used than tablets produced with gelatin as demonstrated in figure 1. This may be attributed to the fact that *Beilschmiedia manni* mucilage forms more cohesive granules with strong solid bridges within the granules and a thick film of mucilaginous barrier between the granules during wet granulation.

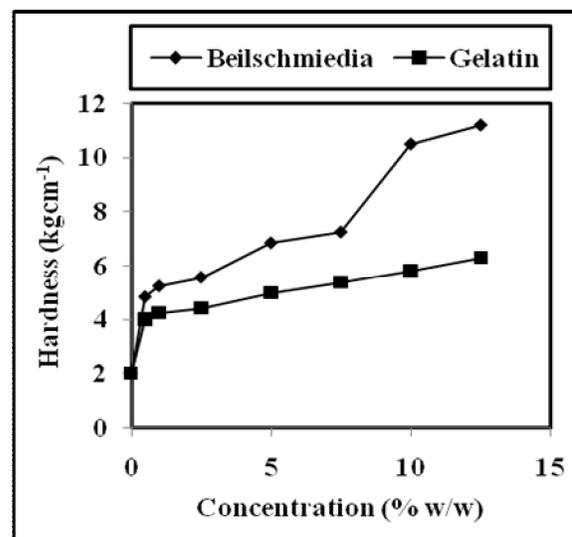
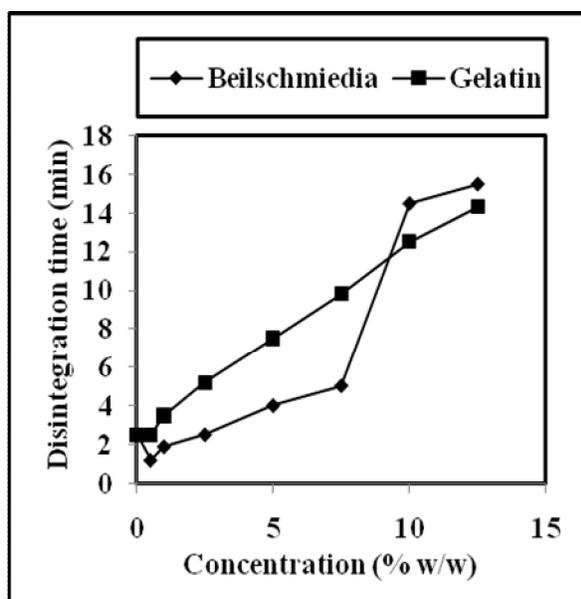


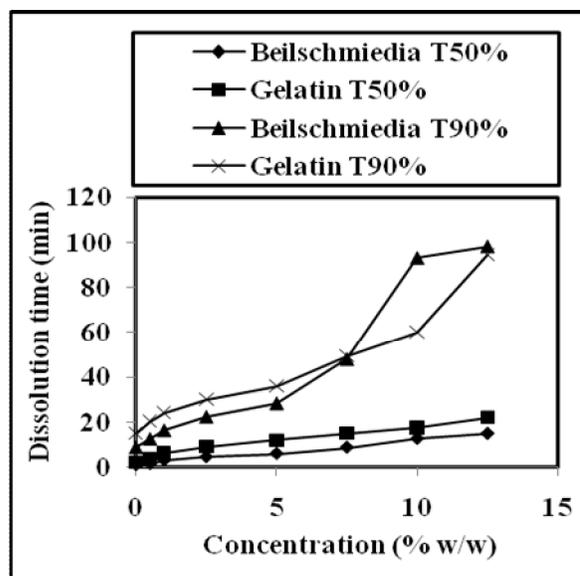
Figure 1: Effect of binder type and concentration on tablet hardness

The disintegration time of tablets produced using *B. manni* mucilage was found to be shorter than that for tablets produced with gelatin (figure 2). This is despite the fact that tablets formulated with beilschmiedia gum exhibited higher values of hardness than those formulated with gelatin. It is worth noting that *Beilschmiedia* gum contains polysaccharides such as starch and reducing sugars. The starch swells up by capillary action when the tablets come in contact with water leading to faster disintegration as compared to gelatin containing tablets.

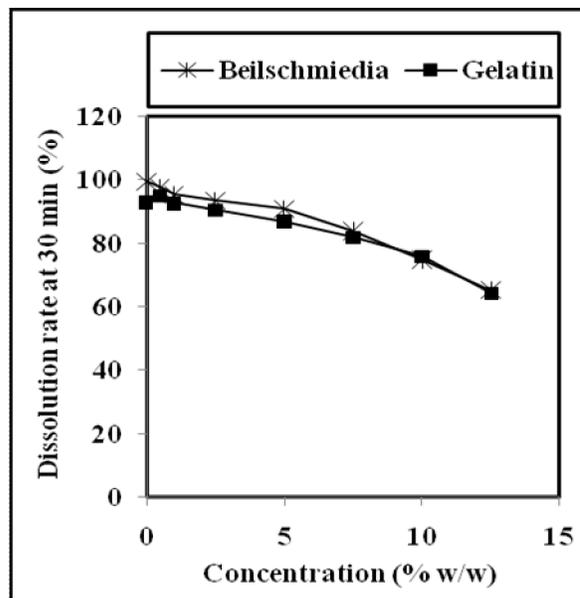


**Figure 2: Effect of binder type and concentration on tablet disintegration time**

Dissolution plays an important role in the bioavailability and therapeutic effect of the active drug in the body. Dissolution time was found to increase with binder concentration (figure 3). This may be explained by the increased interparticulate bonding in the tablet with subsequent enhancement of tablet hardness. The official compendia specify that not less than 80 % of labelled paracetamol should be dissolved in 30 min. As demonstrated in this study tablets produced using 0.5-7.5 % w/w *Beilschmiedia* gum showed high dissolution within 30 minutes (figure 4).



**Figure 3: Effect of binder type and concentration on tablet dissolution rate (T<sub>50</sub> % and T<sub>90</sub> %)**



**Figure 4: Tablet dissolution rate at 30 min**

## CONCLUSION

The mucilage obtained from *Beilschmiedia manni* seeds produced tablets that compare favourably with those containing official gelatin when used at a concentration of 1-5 % w/w. The gum may be useful for the production of tablets such as antacids which require fast disintegration.

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