Some Physical Properties of Tabletted *Bridelia ferruginea* Leaf Extract

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Abstract

This paper is an attempt at formulating an indigenous medicinal plant into a modern pharmaceutical tablet dosage form. The dried leaf extract of *B. ferruginea* was formulated into tablet dosage form using three standard binders at concentration levels of 2-8 %w/w. Some physical properties of the tablets such as; hardness, friability, disintegration time, dissolution rate and content uniformity were evaluated. The tablets had satisfactory physical properties with exception of those batches containing 4- 8 %w/w SCMC that failed the disintegration test. Tablets containing SCMC also showed the highest hardness and least friability. Since most of the tablet batches had satisfactory physical properties, it is possible to employ the named binders in the formulation of the conventional tablets of *B. ferruginea*.

Keywords: *Bridelia ferruginea*, tablets, hardness, friability, disintegration time, dissolution rate.

Introduction

Formulations of plant drugs into modern pharmaceutical dosage forms involve an integration of basic scientific knowledge of pharmaceutical sciences and formulations. Crude drug formulation into modern tablet dosage form requires a judicious use of various tablet excipients in specified amounts (1). Standardization of the crude drug is vital in order to ensure dosage uniformity and precision. Tablet properties such as hardness, friability, content uniformity, disintegration time and dissolution rate might be affected by the type and concentration of the excipient used in the formulation.

The leaf of this plant (*Bridelia ferruginea*) has been used in Nigeria for the treatment of diabetes mellitus and has been reported to lower fasting blood sugar levels of maturity onset diabetes, even in the presence of ketosis (2). In this paper the effect of different binders on the physical properties of *Bridelia ferruginea* leaf extract tablets was investigated.

Materials and Methods

The following materials were used; lactose, gelatin, magnesium stearate (BDH); polyvinylpyrrolidone, sodium carboxyl methylcellulose and maize starch (M&B). The leaves of the plant were collected in the month of May and identified as *Bridelia ferruginea.* Mr. A Ozioko of Botany Department, University of Nigeria, Nsukka confirmed the identity of the plant. Voucher specimens were also deposited in the same department.

Preparation of the crude drug material: The preparation of *B. ferruginea* leaf extract was accomplished adopting a method used in an earlier study on *B. ferruginea* leaf (3). The leaves were dried at 50° C for 48 h. A hammer mill (Manesty, Liver pool) carrying a 2mm sieve was used to grind the leaves of this plant material. Methanol/ water (1.9) was employed as the extracting solvent mixture.

Assay of rutin: A stock solution of rutin (1.0 %w/w) was prepared using methanol / water (1.9). This solution was diluted serially to give a concentration range of between 0.01 and 0.1%w/w for the preparation of a Beer's plot.

Assay of *B. ferruginea:* A sample of the dry leaf extract (50 mg) was introduced into a separatory funnel. A 50 ml solution of methanol / water (1.9) was added and shaken for 5 min. This was extracted for 2 mins with 50 ml of chloroform using a separatory funnel. The chloroform fraction was discarded. A yellow coloration was developed using a freshly prepared 5% $AlCl_3$ solution. The absorbance was read at 405 nm, using as blank a sample of the purified extract stock solution. The assay was done 5 times and the average result calculated.

Formulation of *B. ferruginea* tablets: The wet granulation method was employed using the following binders; polyvinylpyrrolidone (PVP), gelatin and sodium carboxyl methylcellulose (SCMC). The binders were used at 2-8 %w/w concentrations. The specified quantity of the crude drug extract (50 mg), lactose and maize starch were blended for 5 min. Binder solution was introduced to the powder mix and mixed for 10 min to give a moist mass. The moist mass was passed through a sieve (1.7 mm) and the granules dried at 50° C for 1 h. The dried granules were further forced through a 1.00 mm sieve. The fines of the granules were mixed with bolted stearic acid. The coarse fraction was also added and mixed for 5 min. The Manesty f-3 tableting machine carrying 9.5 mm concave punches was used to tablet the granule mix for each batch using a fixed target weight of 300 mg. The compression force of the tabletting machine was set at 50 KN.

Uniformity of weight test: Twenty tablets were randomly selected from each batch and weighed individually and collectively using an electronic weighing balance (Satorius, model 404/48 Germany). The average weight of the tablets was calculated.

Hardness test: The Monsanto hardness tester was used for the test, using ten tablets selected at random from each batch. The average hardness of the tablets was calculated.

Friability test: Twenty tablets were selected at random from each batch and their weight collectively determined as (A1). An Erweka friabilator (model TAR) was used to determine the friability of the tablets. It was made to rotate at 25 r.p.m for 4min. The tablets were dedusted at the end of the run and weighed (A). Friability was calculated from this equation.

$$F = \frac{A - A}{A} * \frac{100}{1} \quad \text{--- Eq. 1.}$$

The test was repeated 5 times and the average value calculated.

Disintegration time: The Erweka disintegration test apparatus (Model ZT4) was used adopting the B.P 1988 method (4). The disintegration medium (0.1N HCL) was kept at 37° C, and five tablets were used for the test. The disintegration time was calculated as the mean time taken for the tablets to deaggregate into particles small enough to pass through the screen mesh of the disintegration test apparatus into the disintegration medium.

Dissolution rate: The B.P 1988 method (4) was employed using 0.1N HCl as the dissolution medium. This medium was maintained at 37°C. One tablet was placed in the basket of the Erweka dissolution apparatus (DT-D) and rotated at 100 rpm. Five-ml portions of the dissolution medium were withdrawn at fixed time intervals using a pipette fitted with non-adsorbent cotton wool. The solution was assayed for the flavonoid active substance using a Sp6-450 uv/vis spectrophotometer (Pye-Unicam), at 405 nm. An equivalent fresh medium was used to replace each 5 ml withdrawn.

Content uniformity: Twenty tablets selected from a chosen batch were crushed to a fine powder. A 300 mg weight of the powder was transferred to a clean separatory funnel. The assay procedure described earlier for *B. ferruginea* leaf extract was then adopted. The test was repeated 5 times and the average value calculated.

Results and Discussion

There was no significant variation in the weight of the tablets. The tablets all passed the BP 1988 test on weight uniformity, since none of them exceeded the deviation of more than 5% from the mean weight.

The effect of binder on the hardness of the tablets is presented in Fig.1.

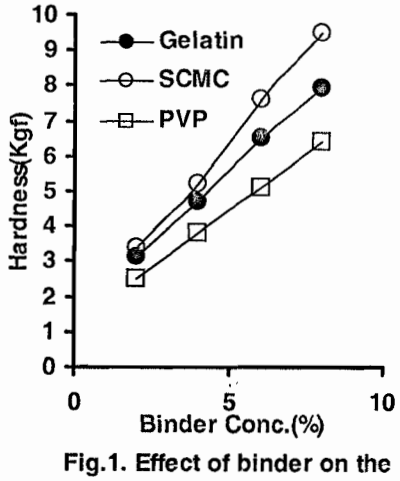

Fig.1. Effect of binder on the hardness of *B. ferruginea* leaf extract tablets

The hardness of the tablets increased with increase in the binder concentration (2 – 8 %w/w). Higher binder concentration increased the adhesiveness /bonding of the binder to the tablet granules and hence its effectiveness (5). SCMC tablets gave the highest hardness while tablets containing PVP showed the least hardness. However, all the tablets produced with 2 %w/w binder had hardness of below 4 Kgf, while tablets formulated with 8 %w/w binder had hardness values of above 6 Kgf.

The effect of binder concentration on the friability of the tablets is shown in Fig. 2.

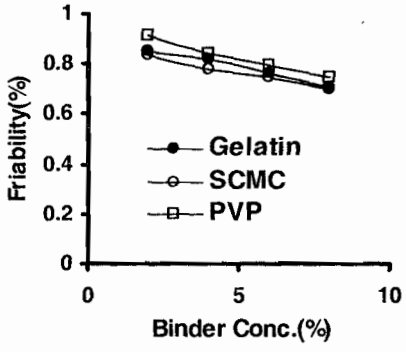

Fig.2. Effect of binder on the friability of *B. ferruginea* leaf extract tablets

Friability decreased as the binder concentration increased. The tablets showed good friability profile generally, since all the tablets had friability of below 0.8 %, excluding the batches produced with 2 %w/w binder. Since friability can be used to asses the ability of tablets to withstand normal risk of handling, it means that the tablets might resist the wear and abrasion encountered in packaging and transportation. The friability of the tablets might be ranked in ascending order as follows; PVP< Gelatin < SCMC.

Fig.3. shows the effect of binder concentration on the mean disintegration time of the tablets. As expected, disintegration time increased as the binder concentration increased. All the tablets containing PVP and gelatin passed the disintegration time test as well as the tablet batches formulated with 2 %w/w SCMC. However, tablets containing 4-8 %w/w SCMC disintegrated after 15 min. Production of firm gels, which coat the tablets and impede hydration, has been shown to account for the long disintegration times exhibited by some hydrophilic polymers (6). The thickness of the gels increases with increase in the polymer concentration of the tablet (7)

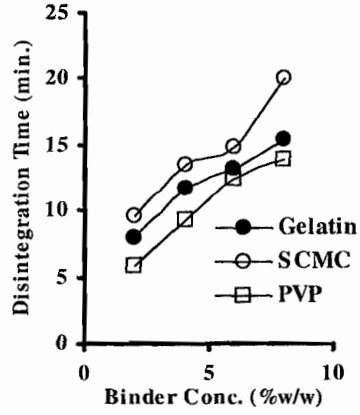

Fig.3.Effect of binder on the disintegration time of *B. ferruginea* leaf extract tablets

The release profiles of flavonoids from the *B. ferruginea* leaf extract tablets formulated with the three binders are shown in Figs. 4 – 6. As expected the release of the flavonoids decreased with increase in binder concentration. PVP showed the highest flavonoid release profiles with the shortest t_{50} values. On the other hand SCMC had the lowest flavonoid release profiles with the highest t_{50} values as shown in Table 1.

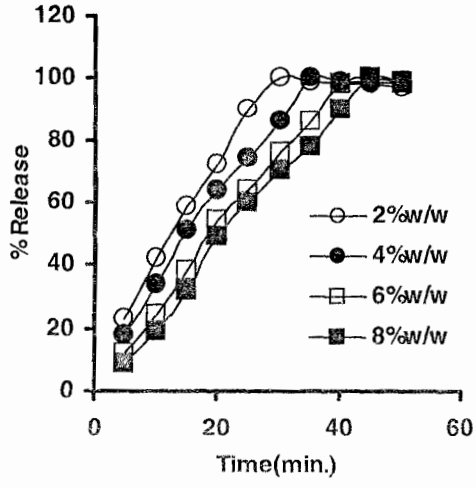

Fig.4. Release profile of flavonoids from *B. ferruginea* leaf extract tablets formulated with PVP as binder

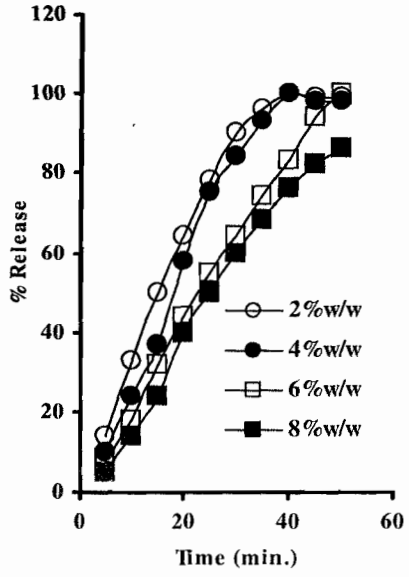

Fig.5. Release of flavonoids from *B. ferruginea* leaf extract tablets formulated with Gelatin as binder

Table 1: T_{50}, t_{70} and t_{90} of flavonoids released from *B. ferruginea* leaf tablets formulated with different binders

Binder Conc. (%w/w)	t_{50}	t_{70}	t_{90}
PVP			
2	12	18	26
4	14	24	32
6	18	26	37
8	21	30	42
Gelatin			
2	15	22	30
4	18	24	34
6	23	35	38
8	25	38	-
SCMC			
2	18	29	38
4	23	37	47
6	28	43	-
8	30	48	-

Conclusion: It is possible to formulate *B. ferruginea* leaf into modern pharmaceutical tablet dosage form since the tablets produced in this study had good physical properties.

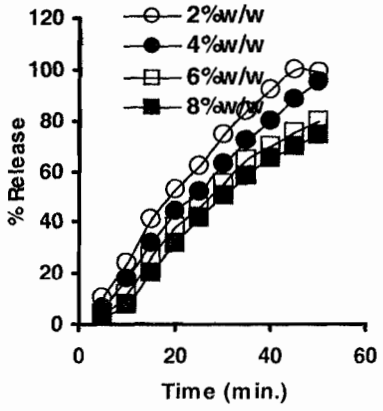

Fig.6. Release of flavonoids from *B. ferruginea* leaf extract tablets formulated with SCMC as binder

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