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Chemical Profile of Unripe Pulp of *Carica papaya*

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Abstract: Unripe pulp of *Carica papaya* was screened to test for the presence of certain phytochemicals. Chemical composition of the pulp were determined. Phytochemical screening of mature unripe pulp of *Carica papaya* (dry weight) showed the presence of saponins and cardenolides while chemical analysis revealed the presence of potassium (223.0mg/100g) as well as sodium, calcium, iron, phosphorus, zinc, copper, magnesium and manganese in considerable quantities. Proximate analysis of the pulp showed that it contained starch (43.28%), sugars (15.15%), crude protein (13.63%), crude fat (1.29%), moisture (10.65%) and fibre (1.88%). All these results indicate that the pulp of mature unripe *Carica papaya* contains nutrients and mineral elements that may be useful in nutrition. The presence of some phytochemicals like saponins and cardenolides explained the astringent action of the plant encountered in the numerous therapeutic uses.

Key words: Unripe pulp of *Carica papaya*, herbal remedies, pawpaw plant

Introduction

Attention have been given to the medicinal value of herbal remedies for safety, efficacy and economy (Glombitza *et al*., 1993; Mahabir and Gulliford, 1997). The pawpaw plant (*Carica papaya*) is widespread throughout tropical Africa; it belongs to the group (*Caricaceae*). The plant can be monoecious, dioecious or hermaphroditic (Purseglove, 1968; Janick, 1988). The pawpaw fruit is a berry, developing from syncarpous superior ovary with parietal placentation (Kochhar, 1986; Rice *et al*., 1987).

Carica papaya is cultivated for its fruits, it is favoured by the people of the tropics, as breakfast, and as ingredients in jellies, preserves, or cooked in various ways. The juice makes a popular beverage; young leaves, shoots and fruits cooked as vegetable.

Papain, the proteolytic enzyme has a wealth of industrial uses. It is used for meat-tenderizers and chewing gums. (Morton, 1987) Cosmetically, it is used in some dentifrices, shampoos, and face-lifting preparations. Fruit and seed extracts have pronounced bactericidal activity against *Staphylococcus aureus, Bacillus cereus, Esherischia coli, Pseudomanas aeruginosa and Shigella flexneri* (Emeruwa, 1982). The juice is used for curing warts, cancer, tumors and indurations of the skin. Leaves have been poulticed into nervous pains, elephantoid growths and it has been smoked for asthma relief in various remote areas. (Reed, 1976). The hypoglycemic effect has been reported by (Olagunju *et al*., 1995). The present study was undertaken to determine the biologically active compounds that contribute to the flavor, colour and other characteristic of plant parts.

Materials and Methods

Fresh, unripe mature fruits of *Carica papaya* (Variety T. solo) were obtained from National Horticultural Research Institute (NIHORT), Ibadan, Nigeria. The fruits were peeled, seeds removed and the pulp cut into small pieces, sundried and finely powered with an electric grinder. The powered material was stored in properly sealed bottles at 10°C in the refrigerator.

Proximate analysis, mineral composition and phytochemical analysis were carried out on dried samples of unripe pulp of *Carica papaya*.

Proximate analysis: Proximate analysis were carried out according to the procedure of Association of Official Analytical Chemist (A.O.A.C .,1990). This constitute the class of food present in samples such as carbohydrate, protein, fat, free sugar, starch fibre, ash content and moisture content.

Mineral composition: This shows the quality of organic and inorganic acid metals present in the samples. The minerals determined are Sodium, Calcium Iron, Phosphorus, Potassium, Zinc, Copper, Magnesium, Manganese, Cobalt, Cadmium, and Lead. The samples were dry ashed at 550°C.

The ash was boiled with 10ml of 20% hydrochloric acid in a beaker and then filtered into a 100ml standard flask. It was made up to the mark with deionized water. The minerals were determined from the resulting solution using Atomic Absorption spectroscopy (Pye unican sp9, Cambridge, UK).

Phytochemical analysis: Phytochemical screening procedures carried out were adapted from the previous work on plant analysis (Odebiyi and Sofowora, 1979; Sofowora and Odebiyi, 1978. This analysis determines the biologically active non-nutritive compounds that contribute to the flavor, colour, and other characteristics

of plant parts. Examples of these are alkaloids, tannins, cardiac glycosides (e.g. cardenolides), anthraquinones, saponin etc.

Determination of alkaloids: 0.5g of the sample was accurately weighed and defatted with 5% ethyl ether for 15mins. The defatted sample was extracted for 20mins with 5.0ml of aqueous HCl on a steam bath. The resulting mixture was centrifuged for 10mins at 3000rpm to remove filtrate (Supernatant). 1.0ml of the filtrate was treated with a few drops of Mayer's reagent and a second 1.0ml portion was treated similarly with Dragendorff's reagent. Turbidity or precipitation with either of these reagents was taken as evidence for the presence of alkaloids (Harbone, 1973; Trease and Evans, 1996

Test for saponius: The ability of saponins to produce frothing in aqueous solution was used as screening test for the sample. 0.5g of dried extract was shaken with water in a test tube, frothing which persist on warming was taken as evidence for the presence of saponins.

Test for tannins: 5.0g of dried extract was stirred with 10.0ml of distilled water. This was filtered and ferric chloride reagent was added to the filtrate. A blue-black precipitate was taken as evidence for the presence of tannins (Trease and Evans, 1996)

Test for anthraquinones: Borntrager's test was used for the detection of anthraquinones. 5.0g of dried extract was shaken with 10.0ml of benzene. This was filtered and 5.0ml of 10% ammonia solution was added to the filtrate. The mixture was shaken and the presence of violet colour in the ammoniacal (lower) phase indicated the presence of free hydroxy anthraquinones (Trease and Evans, 1996).

Test for cardiac glycosides: 0.5g of dried extract was dissolved in 2.0ml of glacial acetic acid containing one drop of ferric chloride solution. This was then under laid with 1.0ml of concentrated H_2SO_4. A brown ring obtained at the interface indicated the presence of a cardenolides.

Results

Table 1 presents proximal chemical composition of unripe pulp of *Carica papaya* (dry weight). It contains considerable amount of starch (43.28%±0.01) which indicates moderate carbohydrate content though the sugar content is low (15.15%±0.02). The percentages of crude protein, moisture and total ash contents are also very low. Results also revealed low fibre and fat contents (1.88%±0.01 and 1.29%±0.01 respectively).

Potassium is the most abundant mineral present in the unripe pulp of *Carica papaya* (Table 2). Magnesium and calcium are present in moderate amounts (23.54 and 12.56mgl100g respectively). Iron and Zinc contents are very low (2.56 and 0.056mgl100g). Manganese and copper were detected in small amounts. Lead cadmium and cobalt which are heavy metals were not detected. Phytochemical screening indicated the presence of saponins and cardenolides (Table 3) in unripe pulp of *Carica papaya*.

Table 1: Chemical composition of unripe pulp of *Carica papaya*

Crude protein	13.63 ± 0.02
Moisture	10.65 ± 0.01
Fat	1.29 ± 0.01
Total ash	14.12 ± 0.02
Starch	43.28 ± 0.01
Sugar	15.15 ± 0.02
Fibre	1.88 ± 0.01

Results are mean of 3 determinations ± SD

Table 2: Mineral composition of unripe pulp of *Carica papaya*

Sodium	4.0
Calcium	24.86
Iron	2.56
Phosphorus	12.56
Potassium	223.0
Zinc	0.056
Copper	0.001
Magnesium	23.54
Manganese	0.008
Cobalt	ND*
Cadmium	ND*
Lead	ND*

ND* = not detected.

Table 3: Phytochemical analysis data of unripe pulp of *Carica papaya* (dry weight)

Alkaloids	-ve
Cardenolides	+ve
Anthraquinones	-ve
Saponins	+ve
Tannins	-ve

Discussion

The proximate analysis shows that unripe pulp of *Carica papaya* can be ranked as carbohydrate rich fruit due to its high carbohydrate and starch contents. Low ash content in the pulp indicates that the total inorganic mineral is low. However, the moisture content is also low, showing that the pulp can be stored for a period of time without spoilage and it will not be susceptible to microbial growth. Low protein values obtained in this study confirms that the unripe pulp is not a good source of protein.

Potassium, calcium and magnesium which are nutritionally important, were found in reasonable amount

in the unripe pulp. Their values are comparable to values reported for some Nigerian agricultural fruits (Duke, 1984b; Umoh, 1995). The high concentration of these minerals could be an advantage. It is known that certain inorganic mineral elements (potassium, zinc, calcium, traces of chromium, etc.) play important roles in the maintenance of normal glucose-tolerance and in the release of insulin from beta cells of islets of Langerhans (Choudhary and Bandyopadhyay, 1999). Lead, cadmium and cobalt were not detected, this indicate that these minerals are not present in a detectable amount in the pulp and this could be of great advantage to the consumers, since some of these minerals like lead, cobalt and cadmium e.t.c have been reported to be highly toxic even at low concentrations, (Asaolu *et al*., 1997).

The presence of secondary plant products in the unripe pulp that are biologically important e.g saponins and cardenolides contribute to its medicinal value. Cardenolides is known to be used in the treatment of congestive heart failure (Schneider and Wolfling, 2004). Also, saponin inhibits Na^+ efflux, by the blockage of the entrance of the Na^+ out of the cell. This leads to higher Na^+ concentration in cells, activating a Na^+ - Ca^{2+} antiporter producing elevated cytosolic Ca^{2+} which strengthens the contractions of heart muscle and thereby reducing congestive heart failure (Schneider and Wolfling, 2004). The hypoglycemic property of unripe pulp of *Carica papaya* may be attributed to the presence of bioactive compound like glycosides, mineral salts and polysaccharides. These compounds which have been shown to be responsible for hypoglycemic activity in *Momordica charantia* (Akhtar *et al*., 1981). In general, these results suggest the validity of the therapeutic effect of aqueous extract of unripe pulp of *Carica papaya*.

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