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The Nutritive and Anti-Nutritive Compositions of Calabash (*Crescentia cujete*) Fruit Pulp

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Abstract: The pulp of calabash fruit (crescentia cujete) has been studied for its nutritive and anti-nutritive compositions in both the wet and dry samples. The values of the ash; 3.74% (dry), ether extract; 4.38% (wet) crude protein; 7.67% (wet) and 10.01% (dry), crude fibre; 4.88% (dry), carbohydrate; 15.65% (wet) and 68.13% (dry) and dry matter; 31.32% (wet) and 87.48% (dry) are quite reasonable for fruits. Both the wet and dry samples have very high concentrations of the mineral elements. Sodium (Na) has the highest values of 3.20% (wet) and 0.32% (dry), while calcium has the least values of 0.12% (wet) and 0.06% (dry). The pulp has very high values of Thiamin; 1.50 μg g^{-1} (wet) and 0.93 μg g^{-1} (dry). Both the wet and dry pulp samples have reasonable values of phytochemicals and are free from HCN toxicity. The pulp can make useful contributions to human nutrition and health.

Key words: Calabash, tropical fruit, pulp, nutritive, anti-nutritive, phytochemicals

INTRODUCTION

Calabash tree is a tropical tree planted in tropical regions. It belongs to the family of *Bignoniacea* and is scientifically known as *Crescentia cujete*. It is native to Central America. The tree is widely distributed to Caribbean region, Mexico, Northern, Southern America and later introduced to tropical Africa after Senegal to Cameroon then to other parts of Africa (Michael, 2004).

It is propagated either by seed or by stem cuttings. It grows up to 6-10 m high with multiple trunks, simple lobe shaped leaves and gourd-like fruit. The branches have simple elliptical leaves clustered at the anode. The greenish flowers arise from the trunk or main branches and bloom at night (Gilman, 1993).

Calabash fruit is a seasonal fruit that develops after pollination by bats. It appears at the end of dry season or beginning of rainy season. The fruit is large up to 12-14 cm in diameter. It is globulose with a smooth hard green woody shell. It takes about 6-7 months to ripen and eventually falls to the ground (Gilman, 1993). The fruit has a white pulp that has medicinal applications and small flat seeds which are embedded in the pulp (Michael, 2004; Burkill, 1985).

In Nigeria, the tree was widely grown in the Northern states but little in other parts of the country. Presently, it is not grown as before because people consider it not very useful so, they cut the trees and use the sticks for cooking and the remaining parts for craft works and other uses.

In South East Africa, the fruit of *crescentia cujete* had been recorded edible. Most of *cujete* consumers consume only the pulp throwing away the shell and the seeds, while some consume the pulp and the seeds throwing away the empty shell (Burkill, 1985).

In Nigeria, the pulp is not generally considered edible rather it is used as an antifly. However, it is consumed in some local communities. The seeds have no known use now while the empty shells are made into storage containers as well as in craft and art works.

This research therefore, intends to determine the nutritive composition as well as the anti-nutritive composition of calabash fruit pulp. It is expected that the result from this research will reveal the usefulness of the calabash fruit in human nutrition and health.

MATERIALS AND METHODS

A mature calabash fruit sample used for the study was plucked from the tree at Oboro in Ikwuano Local Government Area of Abia State, Nigeria.

The fresh f ruit was cut open and the pulp was scooped out. The flat seeds were carefully removed from the pulp. The pulp was spread out on a laboratory tray and dried in a moisture extraction oven at 65°C until dry enough to grind. The dried sample was milled to obtain the powdery sample used for the study. The wet sample of the pulp was also used for the study.

The moisture, protein, phenol and vitamin C content were determined by the method of 'AOAC (1990). The ash, crude fibre, fat, carbohydrate and the mineral elements; Ca, Mg, Na, K and P. were determined by the method of James (1995). The Alkaloids, Flavonoids and Saponins were determined by the method of Harbone (1973). Tannin was determined by the method described by Sofowara (1993). HCN was determined by AOAC (1998) method. Vitamin A was determined by the method described by Kirk and Sawyer (1998). Vitamin E was determined as described by Pearson (1976), while Thiamin, Riboflavin and Niacin were determined by the method of Skalar Analyzers (2000).

RESULTS AND DISCUSSION

The results show that the dry pulp has higher values of Ash, Protein, Fibre, Carbohydrate, Dry Matter and Tannins but lower values of ether extract and moisture.

Table 1 presents the proximate composition of the wet and dry pulp of the fruit. The dry pulp has higher values of ash, protein, fibre, carbohydrate and dry matter.

The values (both in the wet and dry forms) are comparable to those of common fruits.

The protein values of the fruit pulp; 10.01% (wet) and 7.67% (dry) are higher than reported values for pineapple; 0.4% and cashew apple; 0.7%. Protein is vital for maintaining health. It also serves as component of nuclear and cytoplasmic structure that takes part in determining and maintaining cellular organization in the body.

The carbohydrate values of 15.65% (wet) and 68.13% (dry) samples are high when compared to common fruits such as Guava and ripe pawpaw with values of 13 and 10%, respectively. Carbohydrate supplies energy to cells such as brain, muscles and blood. They contribute to fat metabolism and spare proteins as an energy source and act as mild natural laxative for human beings and generally add to the bulk of the diet (Gordon, 2000).

Fruits are not good sources of fat. However, some fruits (oily fruits) such as Avagado pear have been reported to have 17-20% oil (Ihekoronye and Ngoddy, 1985). Higher values have also been reported for some fruits (Fotso, 1994). However, the lipid values of the pulp; 4.38% (wet) and 0.70% (dry) are high compared to some common fruits such as banana; 0.3 mg%, apple; 0.4 mg%; guava; 0.4 mg%, while traces have been recorded for such fruits as grape, mango, melon, carica papaya etc. (Platt, 1962). Fruits are usually recommended as part of weight-reducing diet because of their low fat content. Low fat reduces the level of cholesterol and obesity (Gordon and Kessel, 2002).

Table 1: Proximate analysis of the wet and dry pulp (%)

	Moisture	Ash	Ether extract	Crude protein	Crude Fibre	Carbohydrate	DM
Wet	68.68	2.92	4.38	07.67	0.70	15.65	31.32
Dry	12.52	3.74	0.70	10.01	4.88	68.13	87.48

Table 2: Mineral composition of the wet and dry pulp (%)

	Na	K	Ca	P	Mg
Wet	3.20	2.24	0.12	0.90	0.73
Dry	0.32	0.42	0.06	0.20	0.35

Table 3: Vitamin composition of the wet and dry pulp

	A $\mu g\ g^{-1}$	C mg 100 g^{-1}	E $\mu g\ g^{-1}$	Thiamin $\mu g\ g^{-1}$	Riboflavin $\mu g\ g^{-1}$	Niacin $\mu g\ g^{-1}$
Wet	3.51	21.12	27.5	1.50	Trace	0.022
Dry	2.70	18.92	18.75	0.93	Trace	Trace

Table 4: Phytochemical composition of the wet and dry pulp (%)

	Alkaloids	Flavonoids	Saponins	HCN	Tannins	Phenols
Wet	0.74	0.52	0.70	0.28	0.64	0.46
Dry	0.46	0.38	0.34	0.23	0.85	0.14

Dietary fibres are also constituents of many fruits. The wet pulp has a value of 0.70%, while the dry pulp has a value of 4.88%. These values are reasonable. A range of values between 0.1 and 6.8% has been reported for selected fruits (Osee, 1970). Yet values of between 10-41% on dry weight basis have been reported for certain fruits (Fotso, 1994). Though dietary fibre cannot be digested by the digestive system of man, they have useful roles in providing roughage that aids digestion (Eva, 1983). Dietary fibre reduces the risks of cardiovascular diseases. The major crude fibre in fruits is Pectin. Pectin has the important function of reducing the rate of sugar uptake as well as the role in gastric emptying. Pectin acts as a good intestinal regulator and a detoxifying agent and effective in diarrhoea therapy.

Table 2 presents the mineral composition of the pulp. The wet pulp has higher values of the minerals than the dry pulp.

Mineral elements form important components of our diets. They occur in fruits in low amounts. But the values of the minerals in the wet and dry pulp of the fruit are quite reasonable. Minerals serve many important functions in the body. Calcium and Magnesium provide bone and tooth strength, help in blood clotting, aids nerve impulse transmission required for muscle contraction (Gordon, 2000; Barbara and Robert, 2001; Suzanne, 2002).

Phosphorous is also required for bone and tooth strength and also serves as part of various metabolic compounds (Gordon, 2000).

Sodium and potassium function as electrolytes and play key roles in ion and extra cellular fluid balance and a major factor in nerve impulse transmission (Gordon, 2000).

Table 3 presents the Vitamin composition of the fruit pulp. The pulp, both wet and dry, has very low values of Vitamins A (3.51 and 2.70 μg g^{-1}), C (21.12 and 18.92 mg 100 g^{-1}), E (27.5 and 18.75 μg g^{-1}) but very reasonable values of Thiamin (1.50 and 0.93 μg g^{-1}) and trace amounts of Riboflavin and Niacin.

Though vitamins are found in trace quantities in fruits, they have important biochemical roles to play in the body. The B-Complex group of Vitamins form Co-enzymes for biochemical reactions in the body.

Table 4 presents the phytochemical composition of the fruit pulp. The wet pulp has higher values of alkaloids, flavonoids, saponins, cyanogenic glycosides (as HCN) and phenol but lower value of tannins than the dry pulp.

Alkaloids, saponins, flavonoids, tannins as well as phenols play very important roles in medicine.

Alkaloids are known for their toxicity, but not alkaloids are toxic. Some have been used as basic medicinal agent for their analgesic, antispasmodic, bactericidal effects (Frantisek, 1998). Flavonoids act as anti-oxidants and protect the cells of the body from free radical damage. Free radicals damage cell and contribute to varieties of health related problems (MacArthur, 1992).

Saponins are known to serve as natural antibiotics and also boost energy (Lipkin, 1995). Saponin has been reported to be useful in reducing inflammation of upper respiratory passage and also chiefly as foaming and emulsifying agents and detergents (Frantisek, 1998).

Tannins have astringent properties that hasten the healing of wounds and prevention of decay. Tannin compounds have anti-microbial activity and are responsible for preventing and treating urinary tract infections and other bacterial infections.

Phenol is a corrosive agent and very toxic to living cells (bacteria). Phenol and phenolic compounds had been extensively used in disinfections and remain the standard with which other bactericides are compared in official test (Cater, 1979).

In South East Africa, the fruit of *cresentia cujete* had been recorded edible but in Nigeria, the pulp is not being considered edible in every part of the country. However, it is consumed in some remote communities.

Although, that it has been reported that the fruit pulp has carcinogenic activity and can produce severe diarrhoea (Plants Database, 2004; Morton, 1981) and is also poisonous to small birds and animals (Burkill, 1985), yet every part of the calabash tree has been found very useful in various medicinal areas.

The bark, leaves, fruit pulp and juice have variously been used as laxatives, diuretic healing, diarrhoea, constipation, haemostatic healing, otitis, postnatal haemorrhage. They have variously been used as pugatives, analgesics, anti-inflammatry agents (Plants Database, 2004; Morton, 1981; Michael, 2004). The pulp, when mixed with *lignum vitae* leaves, has been used to treat diabetes (Plants Database, 2004; Morton, 1981). The unripe pulp has been used as a laxative, antipyretics, emollient healing and for headaches, coughs, Pneumonia, burns, haematoma, shingles, tetanus, vomiting, convulsion, menstrual irregularities, prostrate disorders, fever etc. (Michael, 2004; Burkill, 1985; Plants Database, 2004; Morton, 1981).

The presence of these phytochemicals has necessitated the utilization of the pulp and other parts of the tree in the treatment of various diseases.

The value of the cyanogenic glycoside (as HNC) is far below toxic consideration.

CONCLUSION

The values of the ash, crude protein, fibre and carbohydrate in the dry pulp as well as the ether and thiamin values in the wet pulp are very reasonable. The values of the mineral elements are also high. These are indications that the pulp, in addition to its useful contributions to human health, as result of the presence of phytochemicals, can also make useful contributions to human nutrition.

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