

PHYTOCHEMICAL SCREENING AND MINERAL COMPOSITION OF CHEWING STICKS IN SOUTH EASTERN NIGERIA

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ABSTRACT

Phytochemical screening of the stems of *Garcinia kola*, *Dennettia tripetala*, *Acioa barteri*, *Dialium guineense*, *Maesobotrya barteri*, *Mallotus oppositifolius* and *Psidium guajava* which are commonly used as chewing sticks in southern Nigeria revealed the presence of bioactive compounds comprising saponins, tannins, flavonoids and alkaloids. The major, minor and trace elements in these chewing sticks were determined: The chewing sticks contained calcium (0.30-1.00%), magnesium (0.06-0.30%), phosphorous (0.10-0.38%), potassium (0.21-0.39%) and sodium (0.03-0.20%). The concentration of fluoride ranged from (0.02-0.11ppm), copper (0.02-0.14ppm), iron (2.86-5.14ppm), zinc (0.31-0.57ppm), manganese (0.00-0.26ppm) and lead (0.00-0.11ppm). Chewing sticks when used without tooth paste is very efficient, effective and reliable in cleaning the teeth of many people in Southern Nigeria, The teeth of the users of chewing sticks are usually strong, clean, fresh and devoid of dental plaques and carries. These results indicate the basis for the preventive and protection of the teeth against caries and plaques by the samples used.

Key Words: Bioactive compounds, chewing sticks, Mineral composition, Dental plaques.

INTRODUCTION

In Nigeria, many indigenous plants are used as spices, food plants or as medicinal plants. Many of these plants possess bioactive compounds that exhibit physiological activity against bacteria and other microorganisms. These plants are reputed to be versatile medicinal remedies against many diseases.

In many African homes, teeth are cleaned in the morning by chewing the root or slim stem of certain plants until they acquire brush-like ends (Sofowora, 1993). The fibrous end is then used to brush the teeth thoroughly. It is a common thing in many African countries, particularly in the rural areas to use chewing sticks in cleaning teeth every morning as opposed to the use of modern tooth paste and brush (Olabanji *et al*, 1996). These chewing sticks have proved to be potent, very efficient, effective and reliable in cleaning the teeth of many people in Africa particularly in Nigeria (Gazi *et al*, 1992, Olabanji *et al*, 1996, Hattab, 1997). The use of chewing sticks is not peculiar to Africans (Sofowora, 1993). They are also used by many cultures since antiquity. It has been observed that the teeth of the users of chewing sticks are usually very strong, clean, fresh and devoid of germs and caries (Gazi *et al*, 1992, Olabanji *et al*, 1996, Hattab, 1997). Little is known of the composition of chewing sticks in South Eastern Nigeria, despite their wide use.

This work reports on the phytochemical constituents, major, minor and trace elements in *Garcinia kola*, *Dennettia tripetala*, *Acioa barteri*, *Dialium guineense*, *Maesobotrya barteri*, *Mallotus oppositifolius* and *Psidium guajava* which are commonly used in South Eastern Nigeria as chewing sticks. The work also examined their possible utilization as substitutes for common tooth paste for the prevention of dental decay.

MATERIALS AND METHODS

The stems of the test plants; *Garcinia kola*, and *Acioa barteri* were collected from Ndume in Umuahia North Local Government Area; *Dennettia tripetala* and *Dialium guineense*, were collected from Umudike Oboro in Ikwuano Local Government Area, Abia State. *Maesobotrya barteri* and *Psidium guajava* were collected from Isiagu in Ebonyi State while *Mallotus oppositifolius* was collected from Uyo in Akwa Ibom State. The specimens were deposited in the chemistry laboratory, Michael Okpara University of Agriculture, Umudike for further preparation and analysis

IDENTIFICATION

Different parts of the study plants (leaves, flowers, stems and roots) were identified in the taxonomy section of the forestry Department,

Michael Okpara University of Agriculture, Umudike.

SAMPLE PREPARATION

The stems of the study plants were cut into pieces and dried in the oven at 65°C for 48 hours. The dried samples were pounded with wooden mortar and pestle; and finally milled into powder with a manual blender. The powdered plant samples were used for chemical analysis.

CHEMICAL ANALYSIS

The major elements comprising calcium, phosphorus, sodium, potassium and magnesium and trace elements (lead, zinc, fluorine, iron, copper and manganese) were determined by the wet digestion extraction methods as described by Udo and Ojiwale (1986), Adeyemi (1995) and Anka *et al* (1995).

The grounded plant samples were sieved with a 2mm rubber sieve and 0.2g of each of the plant samples were measured into 25ml round bottom flask and digested using 5ml of nitric acid (HNO₃) and 2ml of perchloric acid (HClO₄). The resultant solution was filtered after adding 15ml of distilled water to the digest. The solutions were filtered into a 50ml volumetric flask and the volume made up to mark with distilled water. A control was prepared using the procedure described above but excluding the plant materials. Following the digestion, the minerals were determined by atomic absorption spectrophotometer, following the development of colour with ammonium molybdate. The results were expressed on dry matter basis. The fluoride content were determined using ultra violet spectrophotometer as described by Adeyemi (1995) and Anka *et al* (1995).

PHYTOCHEMICAL SCREENING:

This was carried out as described by Harborne (1973), Trease and Evans (1978) and Sofowora (1993). The plants were qualitatively screened for tannins, saponin, terpenoids, alkaloids, flavonoids and phenol.

RESULTS AND DISCUSSION

Table 1. shows the major, minor and trace elements in the chewing sticks. The various chewing sticks contain appropriate amounts of the major elements; calcium, phosphorous, potassium and magnesium. The plants are rich in calcium with *M. Oppositifolius* having the highest calcium content of 1.00% followed by *D. guineense* (0.60%) and *M. barteri* (0.50%);

The enormous concentration of calcium in the plants analysed is very significant because calcium is known to enhance the qualities of bones and teeth. (Collins 1975).

Some components of the chewing sticks may be cariostatic since they contain phosphorus and fluoride. Phosphates have been shown to exhibit a marked protective influence on teeth (Duggal and Curzen, 1993 and Stadler *et al*, 1996). Inorganic phosphates have been demonstrated to have a protective influence on teeth when added to cariogenic diets. Organic phosphates such as phytates and glycerophosphates also have a cariostatic action and are thought to reduce the cariogenicity of diets (Duggal and curzen, 1993). The Local effects of phosphates can be attributed to various properties. Phosphates are not only efficient and effective buffers, which can buffer organic acids produced by plaque flora, they are also known to be good in reducing the rate of dissolution of

Table 1: Mineral Composition of Local Chewing Sticks

	Major mineral %				Trace Mineral (ppm)						
	Ca ²⁺	Mg ²⁺	K ⁺	P	Na ⁺	Pb ²⁺	Zn ²⁺	F	Fe ²⁺	Cu ²⁺	Mn ²⁺
<i>Garcinia kola</i>	0.30±0.1	0.12±0.10	0.26±0.20	0.30±0.10	0.030±.10	0.11±0.10	0.57±0.30	0.05±0.10	4.430.3	0.06±0.10	0.26±0.20
<i>Denettia tripetala</i>	0.30±0.1	0.06±0.04	0.39±0.20	0.23±0.20	0.25±0.30	0.00	0.43±0.20	0.02±0.20	3.43±0.20	0.0±0.01	0.11±0.1
<i>Acioa barteria</i>	0.40±0.02	0.18±0.01	0.21±0.01	0.15±0.30	0.10±0.20	0.00	0.34±0.10	0.06±0.10	2.57±0.10	0.14±0.20	0.00
<i>Dialium guineense</i>	0.60±0.30	0.18±0.2	0.21±0.02	0.15±0.10	0.15±0.10	0.00	0.31±0.20	0.11±0.20	4.14±0.01	0.03±0.01	0.00
<i>Maesobotrya barteri</i>	0.50±0.20	0.24±0.30	0.21±0.30	0.10±0.20	0.10±0.01	0.11±0.10	0.34±0.10	0.05±0.30	5.14±0.10	0.06±0.30	0.16±0.10
<i>Mallotus oppositifolius</i>	1.0±0.01	0.30±0.10	0.40±0.10	0.10±0.20	0.28±0.20	0.00	0.40±0.10	0.05±0.10	4.43±0.20	0.09±0.10	0.11±0.20
<i>Psidium guajava</i>	0.50±0.20	0.18±0.20	0.46±0.20	0.13±0.20	0.20±0.10	0.00	0.37±0.20	0.03±0.10	2.86±0.10	0.16±0.10	0.16±0.10

Values are means ± S.D. of the three determinations

Table 2 Phytochemical Screening of the Stems of Study Plants.

Sample	Saponin	Tannins	Flavonoid	Alkaloid	Phenol
<i>Garcinia kola</i>	+	-	+	+	+
<i>Demmettia tripetala</i>	+	+	+	+	+
<i>Dialium guineense</i>	+	+	+	+	+
<i>Maesobotrya barteri</i>	+	-	+	+	+
<i>Mallotus oppositifolius</i>	+	+	+	+	+
<i>Acioa barteri</i>	+	-	+	+	+
<i>Psidium guajava</i>	+	+	+	+	+

+/- = Presence or absence of the component tested.

hydroxy apatite. The concentration of iron in the plants screened were relatively high. *M. barteri* had 5.14ppm of iron, followed by *G. kola* and *M. oppositifolius* which respectively contained 4.43ppm and 2.57ppm of iron.

The concentration of manganese, copper and lead were relatively low (Table 1). Lead was not detected in *D. tripetala*, *A. barteri*, *D. guineense*,

M. oppositifolius and *P. guajava*. Lead was only detected in Minute amounts of 0.11ppm in *G. kola* and *M. barteri* respectively. All the plants screened contained fluoride and copper in trace amounts while the concentration of zinc was high in many of the plants sampled (Table 1).

Manganese was not detected in *A. barteri* and *D. guineense*. The natural content of fluorides in plants varies very widely in different places depending on the chemical nature of the soil and rocks in which the plants grow (Clegg and Clegg, 1982) The fluoride of the body is mainly concentrated in the bones and teeth, where it becomes incorporated into the crystals of apatite that form the hard inorganic component of the tissue. Teeth containing fluoride are much less likely to develop caries, and the more fluoride present, the more resistant the teeth becomes (Clegg and Clegg, 1982).

It is well documented that the surface enamel is more resistant to carries attack than the subsurface dentine (Macral *et al*, 1993) This is attributed to a higher concentration of fluoride and other trace metals such as zinc, lead, copper, iron and manganese which are thought to protect the surface enamel from demineralization (Macral *et al* 1993 and Olabanji *et al*, 1996).

Although, there is sufficient evidence to support the direct relationship between the

fluoride content of the surface layer of enamel and its resistance to carries attack, the relationship of other trace elements is unclear and still being investigated. However, iron is known to

be an important element in human body. It is a component of hemoglobin. It helps in oxygen transport. Iron, together with hemoglobin and ferredoxin play vital roles in man's metabolism. It is worthy of note that magnesium, zinc, sodium, phosphorous and calcium are present in all the chewing sticks. The combination of these elements together with fluoride may have therapeutic, protective and preventive roles in teeth (Olabanji *et al*, 1996).

Lead was detected in minute amounts in *G. kola* and *M. barteri* but not in the others (Table 1). Lead, most often affects blood, kidneys and nerves. The symptoms are: anemia from interference with red blood cell production; chronic nephritis which may contribute to hypertension and ultimately kidney failures; effects on the nervous system as seen in behaviour problems characterized by convulsions or swelling of the brain (Wagner, 1971). However, the concentration of lead in these plants is minute. Normal levels of lead in blood range between 0.05 and 0.4ppm. Above 0.8ppm, recognizable lead poisoning normally result (Wagner, 1971).

Phytochemical Screening revealed the presence of bioactive compounds comprising saponins, tannins, flavonoids, phenolic compounds and alkaloids. (Table 2). These phytochemical compounds are known to have antimicrobial activity (Ebana *et al*, 1995). Some of the properties of saponins have been put to use in medicine, pharmaceuticals and technology (Sodipo *et al*, 2000). The foaming ability of saponins has been used to produce the frothy effect in the food industry (George, 1965). In addition, some countries have also included them in the list of flavouring agents (George, 1965). Moreover, saponins, are used in the manufacture of shampoos, insecticides and various drug preparations and synthesis of steroid hormones (Sodipo *et al*, 2000). The foaming ability of

saponins is very useful in the chewing sticks for their inhibitory roles on microorganisms and their cleansing actions of the teeth. The presence of phenolic compounds in these samples indicates that they might be antimicrobial agents. Phenols and phenolic compounds had been extensively used in disinfection and remain the standard with which other bactericides are compared. The plants therefore have therapeutic, antiseptic or bactericidal properties. The present study has verified the usefulness of *G. kola*, *D. tripetala*, *A. barteri*, *D. guineense*, *M. barteri*, *M. oppositifolius* and *P. guajava* as medicinal plants. The stems of these plants may be promising in keeping the teeth healthy.

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