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EVALUATION OF THE CHEMICAL COMPOSITION OF INDIGENOUS SPICES AND FLAVOURING AGENTS

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ABSTRACT

The work reports the chemical evaluation, nutritional and flavouring potentials of six indigenous spices (*Zingiber officinale, Piper guineensis, Xylopia aethopica, Tetrapleura tetraptera, Monodora myristica* and *Cocos nucifera*).

The spicies contains crude protein (8.31 –38%), crude lipid (1.50 - 65.10%), carbohydrate (12.98 – 75.16%), crude fibre (3.23 – 8.30%) and food energy (371.66 – 671.06 g/cal). The spices are sources of minerals (Phosphorus, calcium, potassium and magnesium). The iodine value from the seed/fruit oils of the spices range from (9.60-87.60mg/100g), peroxide value (0.40-8.50 mg/g oil) saponification value (4.80-260mg/KOH/g oil) and the acid value (15.00-190.74 mg/COOH/g oil). The peroxide value in the spices are generally low indicating good storage and flavouring properties.

Keywords: Flavour, Nutritive Value, Spices, Storage.

INTRODUCTION

In Nigeria, many indigenous plants are used as spices, food plants or as medicinal plants. Spices are used to add flavour, relish or piquancy to foods. Modern food processors use spices to give appealing and appetizing flavours to food.

Achinewhu *et al* (1995) reported that indigenous spices and herbs are used to prepare peper soups which exhibit hot and spicy taste which are consumed during the cold season.

Okwu (1999) reported that some forest fruits and seeds are sometimes added to food meant for pregnant and nursing mothers as medicinal spices. Among the post partum women, it is calimed that spieces and herbs assist in the contraction of the uterus (Achinewhu *et al* 1995). Spicies and herbs are generally known to possess antibacterial and antioxidant properties (Atkinson *et al* 1947, Iwu, 1989).

It is well documented (Okogun and Ekong 1974, Okwute, 1992) that some of these forest fruits and seeds have potent anti fungal and antiviral properties.

Considering the importance of these wild fruits and seeds which are commonly used as spices in flavouring food, it is necessary to investigate the properties of the indigenous spices (*Zingiber officinale, Piper guineensis, Xylopia aethiopica, Tetrapleura tetraptera, Monodora myristica* and *Cocos nucifera* which are commonly consumed in Nigeria.

The aim of this study is to investigate the chemical composition of the spices and determine their flavouring properties, their ability to be used as food additives and preservatives.

Ginger (*Zingiber officinale Rose*) is cultivated as an annual crop which is propagated vegetatively to yield fleshly underground rhizome (Ebewele and Jimoh, 1988). Preserved ginger is prepared from the immature rhizome while the more pungent and aromatic spice is prepared by harvesting and drying the mature rhizome.

Dried ginger is used directly as a spice and also for the preparation of its extractive, ginger oil, and ginger oleoresin. The ginger oleoresin possesses the full organoleptic properties of the spice, that is aroma, flavour and pungency, and find similar applications to the ground spice in flavouring processed foods (Ebewele and Jimoh 1988).

Xylopia aethiopica is found in Lowland rain forest and fringing forests in the savanna zones (Keay, 1989). The seed has pepper

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taste while the fruit is used as condiment. (Oliver-Bever 1986).

The main chemical constituents isolated from *X. aethiopica* comprises mainly Xylopic acid, a new diterpenic acid (15 β – acetoxy (-) Kauran-16-ene-19- oic acid), three diterpenic alcohols, one of them identified as Kauran-16-α- ol, 4-diterpenic acids, fats, oils and essential oils (Oliver-Bever, 1986). It is the essential oils that enhanced the aroma of foods. Also the various acids are responsible for the taste or hot taste which characterised *X. aethiopica*.

Tetrapleura tetraptera is a medium sized decidous forest tree found commonly in the rain forest. The bark is smooth, greyish, very thin slash reddish and strong smelling (Kaey 1989). The fruits are brown and usully slightly curved with ridges. *T. tetraptera* is used as tonic and stimulant (Adesina and Sofowra, 1979). Besides oil, *T. tetraptera* contains resins, fats, carbohydrates, colouring matter and fatty acids. Screening of the fruits of *T. tetraptera* revealed the presence of oleanic acid, triglycoside and scopoletin, a coumarin (Oliver-Bever, 1986). It is perhaps, the presence of coumarin that is responsible for the aroma, the fruit often imparted upon food and its ability to serve as a potential condiment in soups.

Piper guineensis is a West African black pepper which normally grow as a climber found commonly in southern part of Nigeria (Okwute, 1992). The fruits of *P. guineensis* has both aromatic constituents and pungent principles. The former is contained in the essential oil while the latter are found mainly in the alkaloids. The pungent alkaloids are responsible for the aroma the fruit often imparted upon foods (Okwu, 1999). The hot taste of *P. guineensis* is due to Piperine-type amide, guineensine 3 and Piperine 4, isolated from the seed.

Okwute (1992) observed that guineensine 3 and Piperine 4 possessed insecticidal activity. *P. guineensis* has potent physiological effects when they are administered to animals. Their activity as bioactive compounds makes it possible for it to be used in many traditional medicinal preparations as well as spice in local foods. It is this flavouring properties and aroma that prompted the utilization of *P. guineensis* as an additive in food meant for pregnant and nursing mothers particularly in eastern part of Nigeria (Okwu, 1999).

Monodora myristica is a tree found commonly in the rain forest (Keay, 1989). The ovoid fruits are commonly used as spice in flavouring food in the eastern Nigeria.

Cocos nucifera (Coconut palm) is a member of the palmae. Coconut oil contains an enormous amount of fatty acids of low molecular weight. The oil is solid at temperatures less than 20°C. It contains more than 80% of saturated fatty acids, mainly lauric, myristic and palmitic. The free endosperm may be ground and pressed to yield "coconut milk" or dried to produced desiccated coconut for use in confectionary and cooking (Umoh, 1998).

MATERIALS AND METHODS

The exprimental fruits and seeds were purchased from Ariam market, Ikwuano, Abia State of Nigeria. The ginger rhizome were supplied by the National Root Crops Research Institute, Umudike. The *Monodora myristica* seed, *Piper guineensis*, dehusked *cocos nucifera* fruit ad fruits of *Xylopia aethiopica* and *Tetrapleura tetratptera* and rhizomes of *Zingiber* officinale were each weighed (400g). The materials were dried in the oven at 65°C for 12 hours. The dried materials were ground into powder and used for analysis.

Table 1: Nutritional Composition of The Spices

Spice	Part Screened	Moisture %	Ash %	Fat/Oil %	Protein N x 6.25%	Carbohydrate	Fibre	Food Energy/g Cal.
Ginger officinale	Stem	16.10 ± 0.10	9.52 ± 0.02	12.20 ± 0.10	15.69 ± 0.06	57.00 ± 0.77	4.53± 0.05	400.56
Piper guineensis	Seed	15.17 ±0.06	9.10 ± 0.07	7.30± 0.10	38.00 ± 0.06	40.29 ± 0.76	4.31± 0.01	378.86
Cocos nucifera	Seed	2.50± 0.01	4.51 ± 0.01	65.10 ± 0.10	8.31± 0.06	12.98 ± 0.82	8.10± 0.07	671.06
Xylopia aethiopica	Fruit	7.10± 0.10	5.10 ± 0.01	12.53 ± 0.06	22.56 ± 0.06	54.07 ± 0.77	4.74± 0.01	419.29
Tetrapleura tetraptera	Fruit	6.10± 0.10	4.73 ± 0.02	1.50 ± 0.01	14.38 ± 0.06	75.16 ± 0.88	3.23± 0.03	371.66
Monodora myristica	Seed	3.55± 0.05	4.73 ± 0.02	42.80 ± 0.01	12.88 ± 0.06	31.96 ± 0.87	8.30± 0.01	572.66

Values are mean ± S. D of three determinations.

Table 2: Mineral Composition Of The Spices

Spice	Part Screened	P g/100g Dry Matter	Mg^{2+} %	Ca^{2+} %	Na^{+} %	K^{+} %	N %
Zingiber officinale	Stem	0.11± 0.01	0.80± 0.10	0.50± 0.10	0.04± 0.20	1.00± 0.50	2.50± 0.01
Piper guineensis	Seed	0.09± 0.01	0.73± 0.01	1.50± 0.20	0.02± 0.10	1.06± 0.01	6.08± 0.20
Cocos nucifera	Seed	0.33± 0.20	0.09± 0.02	0.17± 0.10	0.08± 0.01	0.75± 0.20	1.33± 0.01
Xylopia aethiopica	Fruit	0.08± 0.01	0.85± 0.30	0.90± 0.30	0.03± 0.01	1.63± 0.10	3.61± 0.30
Tetrapleura tetraptera	Fruit	0.06± 30	0.61± 0.01	0.71± 0.20	0.03± 0.10	1.00± 0.01	2.30± 0.01
Monodora myristica	Seed	0.14± 0.01	0.09± 0.20	0.21± 0.30	0.05± 0.20	0.30± 0.01	2.38± 0.01

Values are means ± S. D of three determinations.

Table 3: PEROXIDE, IODINE, ACID AND SAPONIFICATION VALUES OF THE OILS FROM THE SPICES

Spice	Part Screened	Iodine Value Mg/100g	Peroxide Value Mg/g oil	Saponification Value Mg /KOH/g oil	Acid Value Mg/COOH/g Oil
Zingiber officinale	Stem	87.60 ± 0.10	6.80 ± 0.10	4.80 ± 0.20	190.74 ± 0.10
Piper guineensis	Seed	12.50 ± 0.01	0.40 ± 0.01	86.00 ± 0.10	20.90 ± 0.20
Cocos nucifera	Seed	10.50 ± 0.01	8.50 ± 0.20	260.00 ± 0.01	50.10 ± 0.10
Xylopia aethiopica	Fruit	10.40 ± 0.10	3.20 ± 0.10	188.00 ± 0.10	16.10 ± 0.30
Tetrapleura tetraptera	Fruit	11.30 ± 0.30	0.40 ± 0.01	87.00 ± 0.20	15.00 ± 0.20
Monodora myristica	Seed	9.60 ± 0.20	2.40 ± 0.10	172.00 ± 0.30	20.50 ± 0.01

Values are means ± S. D of three determinations.

CHEMICAL ANALYSIS

Moisture, crude fat (ether extract), crude protein, crude fibre and ash content were determined according to AOAC (1984) methods. Total carbohydrate was estimated as the remainder after accounting for ash, crude fibre, protein and fats. The gross food energy was estimated using the equation.

FE = (% CP x 4) + (% Lipids x 9) + (% CHO x 4)

where:

FE = Food energy (in grams calories)
CP = Crude Protein
CHO = Carbohydrates.

The levels of minerals were obtained according to AOAC (1984) methods. The saponification value was obtained by Williams method (Williams, 1950). The iodine number was determined by Strong and Kock method (Strong and Kock, 1974). The acid and peroxide values were determined using Pearson method (Pearson, 1976).

RESULTS AND DISCUSSION

Table 1 shows the Crude Protein, fat and total carbohydrate contents of the test samples. The spices contained appreciable amounts of these basic food nutrients. The value of the crude Protein in all the spices invistigated are very high, however *P. guineensis* has the highest protein value of 38%. Plant protein may be consumed as whole plant or leaves, raw, dried or cooked. (Enwere 1998).

The spices are not only rich in proteins but also in calories. *C. nucifera* has the highest food energy of 671.06g calorie.

The high energy value in *C. nucifera* might have been due to its high oil content of 65.10%. *C. nucifera* has more lipid content than the others (Table 1). The lipid content of 65.10% obtained in *C. nucifera* agreed with the result obtained by Umoh (1998) who reported that fully mature coconut contains 60-70% by weight of oil. This high lipid content in *C. nucifera* is an indication of its potential as a source of vegetable oil. *P. guineensis*, *X. aethopica* and *Z. officinale* have low lipid content but *T. tetraptera* has the least 1.50% lipid content.

The total carbohydrates available in the spices are very high with *T. tetraptera* recording the highest value of 75.16% dry weight. This value agreed with earlier research conducted by Achinewhu *et al* (1995).

The value of crude fibre in the spices is also high with *M. myristica* and *C. nucifera*

having crude fibre content of 8.30 and 8.10% respectively. The high fibre contents has a far-reaching implication in human nutrition such as increase in feacal bulk and lowering of gastric cholesterol (Umoh 1988, Enwere, 1998).

Table 2 shows the contents of essential minerals: calcium, potassium, phosphorous and sodium available in the spices. These minerals are very important in human nutrition. Among the factors influencing the mineral composition of plant fruits/seeds include soil fertility (or type and quality of fertilizer used) in its cultivation. (Schmidt, 1971). This perhaps is the reason behind the wide variation observed among these spices (Table 2). Specifically, these spices have low sodium content but comparatively retain high levels of potassium (Table 2).

Table 3 shows the peroxide, iodine, acid and saponification values of the oils. The peroxide value was low with *P. guineensis* and *T. tetraptera* having values of 0.40 mg/g oil. Pearson (1976) reported that fresh oils usually have a peroxide value below 10mg/g oil. A rancid taste is observed when the peroxide value is between 20 and 40mg/g. (Pearson, 1976). The spices therefore will have a long shelf life because of low peroxide values. Following the higher iodine value obtained in *Z. officinale Rose* (87.60%) the oils from this plant can easily go rancid because of the availability of unsaturated bonds. It is well documented (Umoh, 1998) that oils from *C. nucifera* become solid at room termperature. This agreed with the saponification value of 260 mg/KOH/g oil obtained from *C. nucifera.* (Table 3). This also indicates that the oils have low molecular weight.

These oils have therapeautic, antiseptic or bactericidal properties. (Edlin, 1967). Apart from their uses as food, spices such as *T. tetraptera, X. aethiopica* and *P. guineensis* are used to prepare pepper soup for women immediately after delivery. It is believed that they strenghtens and heals the walls of the womb. *X. aethiopica* is used to treat the navel of new born baby which not only heals it fast but also prevents any form of infection.

The outcome of this investigation has greately elucidated the nutritive composition of the spices as quality food with good storage properties. They are recommended as food supplements which its cultivation in home gardens should be encouraged to avoid the plants from going extinct due to deforestation.

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