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Nutritional Evaluation of Some Selected Spices Commonly Used in the South-Eastern Part of Nigeria

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Abstract
Proximate composition, vitamin contents and mineral contents of four commonly used spices in the south-eastern part of Nigeria were investigated. The spices are *Myristica fragrans, Rosmarinus officinalis, Monodora myristica* and *Piper guineense.* Proximate analysis showed moisture contents of 10.83% in *Rosmarinus officinalis,* 12.78% in *Monodora myristica* and 12.35% in piper guineense .crude fibre contents ranged from 8.79% in (*Piper guineense*) to 14.26% in *Rosmarinus officinalis*. Crude fat ranged from 3.48% in *Rosmarinus officinalis* to 13.34% in *Myristica fragrans.* Crude protein ranged from 5.86% in *Piper guineense* to 14.30 in *Rosmarinus officinalis*; while carbohydrate content ranged from 41.57% in *Myristica fragrans* to 57.32% in *Piper guineense*. Ash content ranged from 6.33% (*Piper guineense*) to 11.78% in *Rosmarinus officinalis*. All samples had high contents of dry matter. The analysis for the vitamin contents of the spices showed the presence of vitamin A, B_1, B_2, B_3 and vitamin C. All four samples had high concentrations of vitamin C. The B complex vitamins for the four samples were of low concentration. The vitamin A levels ranged from (7.08 µg/g) in *Piper guineense* to 14.87 µg/g in *Rosmarinus officinalis.* The test for mineral content of the four samples showed that the spices contain calcium, magnesium, potassium, sodium, phosphorus and iron. The calcium concentration of the four spices are quite high. Also the spices contain high concentrations of phosphorus. *Piper guineense* contains the lowest potassium level of (98.52 mg/100g) when compared with *Myristica fragrans, Monodora myristica* and *Rosmarinus officinalis* which posses (334.78 mg/100g, 316.64 mg/100g and 343.82 mg/100g) respectively. Magnesium content ranged from 35.54 mg/100g in *Piper guineense* to 85.66 mg/100g in *Rosmarinus officinalis.* The iron (Fe) concentrations appeared to be the lowest compared with other minerals in all the spices.
Keywords: Nutritional, evaluation, selected, commonly, spices.

1.Introduction

Spices are the building blocks of flavor in food applications. The word "spice" came from the Latin word "species", meaning specific kind. The name reflected the fact that all plant parts have been cultivated for their aromatic, fragrant, pungent or any other desirable properties including the seed (aniseed, caraway, coriander), kernel (nutmeg), aril (mace), leaf (cilantro, kari, bay, mint), berry (all spice, juniper, black pepper), stem (chives), stalk (lemon grass), rhizome (ginger, turmeric), bulb (garlic, onion), fruit (star anise, cardamom, chile pepper), flower (saffron) and flower bud (clove).For people throughout the world, spices stimulate the appetite, add flavor and texture to food and create visual appeal in meals (Susheela, 2000).Spices are also being sought for their medicinal value, as antioxidants and as antimicrobials. This study was therefore carried out to evaluate the nutritional compositions of some of these spices. Nutmeg is a light-brown or grayish wrinkled seed inside a smooth hard blackish brown nut. The nut is dried in the sun until the inner seed rattles when shaken.

Nutmeg has 6.5% to 16% essential oil, which is pale yellow in color and is called oil of *Myristica*. Depending on the source, the essential oil has mainly sabinene (15-50%), α-pinene (10-22%) and β-pinene (7-18%), with myrcene (0.7-3%), safrole (0.1-3.2%) and terpinen 4-01 (0-11%), and also 1, 8-cineole (1.5-3.5%), *Myristicin* (0.5-13.5%), Limonene (2.7-4.1%).The fixed oil is a pale yellow viscous oil, and 6 Ibs of Oleoresin is equivalent to 100 Ibs of freshly ground nutmeg (Susheela, 2000).

Nutmeg has been used to improve sexual function and enhances the sex drive. It has been suggested that nutmeg may be a safe and effective herbal remedy in treating sexual disorders (Tajuddin *et al*., 2003; Tajuddin *et al.,* 2005).It has also been used as an aphrodisiac. Eugenol may be responsible for some of the aphrodisiac effect because of its vasolidatory and smooth muscle relaxant properties (Tajuddins *et al.,* 2003; Tajuddin *et al*., 2005).

The National Cancer Institute has screened the Myristicaceae plant family for activity against leukemia, 18.8% exhibited anti-leukemia activity. Invitro studies with methanolic extract and *Myristicin* have shown increased apoptosis and decreased leukemia and neuroblastoma cell proliferation (Cragg *et al*., 2006; Chirathaworn, 2007; Lee *et al*., 2005).The effects of nutmeg on the CNS are variable and reflect anticholinergic and CNS excitatory and depressant effects. Dopaminergic and scrotonin pathways may be involved (Forrester, 2005; Sangalli and Chiang, 2000; El-Alfy, 2009; Dhingra, 2006; Sonavane *et al*., 2002).

Anti convulsant activity in mice has also been demonstrated (Sonavene *et al*., 2001; Wahab, 2009).In diabetes, nutmeg has shown insulin-like activity in vitro (Broadhurst *et al*., 2000)

Rosemary is a flavoring that is deeply rooted in European cultures. It was native to the Mediterranean region and

has been used since 500 BC. It was noted for strengthening the memory. Today, it is still a popular spice in Europe, especially in Italy and France and also in some South-eastern part of Nigeria (Susheela, 2000).. Rosemary leaves have a slightly minty, sage-like, peppery, balsamic and camphor-like taste with a bitter woody after taste. The stems and flowers are also aromatic.

Rosemary contains 0.5-2.5% volatile oil, mainly 1,8-Cineol (30%) which gives rosemary its cool eucalyptus aroma) , borneole (16-20%). Camphor (15-25%), bornylacetate (2-7%) and α-pinene (25%). Rosemary extract has been shown to improve the shelf life and heat stability of omega 3-rich oils, which are prone to rancidity (Oregon, 2007).

It has been used traditionally to treat whooping cough, fluid retention, poor circulation, jaundice, migraine, mental fatigue, panic attacks, irritability and aching joints. The Romans use it for insect bites. French used it to sanitize the air in hospitals.

In ancient times, it was used to preserve meat and as a fumigant in hospitals to kill bacteria. (Susheela, 2000).Rosemary is extremely high in ion, calcium and vitamin B_3, it also contains a large number of polyphenolic compounds that can inhibit oxidation and bacterial growth (Grotto, 2008).

In cancer prevention studies, rosemary has been found to protect the blood against radiation exposure (DelBano, 2006). Rosemary may also help with memory loss (Moss, 2003)

Monodora myristica is the seed of a tropical tree of the family *Annonaceae* or custard apple family of flowering plants. In former times, its seeds were widely sold as an inexpensive nutmeg substitute. Nowadays however, this is less common outside its region of production (Celtnet, 2011). Other names of calabash nutmeg include Jamaican nutmeg, African nutmeg, Ehuru, ariwo, awerewa (Burkill, 1985), ehiri, airama, African orchid nutmeg, muscadier de calabash and lubushi (Celtnet, 2011; Weiss, 2002).

The calabash nutmeg tree grows naturally in evergreen forests from Liberia to Nigeria and Cameroon, Angola and also Uganda and West Kenya (Weiss, 2002).The odour and taste of the Monodora myristica seed is similar to nutmeg and it is used as a popular spice in the West African Cuisine (Celtnet, 2011). The fruits are collected from wild trees and seeds are dried and sold whole or ground to be used in stews, soups, cakes and desserts (Celtnet, 2011; Weiss, 2002).

The essential oil obtained from the leaves contains β-caryophyllene, , α-humulene and α-pinene. The major compounds found in the essential oil from the seeds are α-phellandrene, α-pinene, myreene, limonene and pinene (Fournier, 1999).

Piper guineense also known as Ashanti pepper, Benin pepper, false cubeb, guinea cubeb or uziza., It is a member of the genus piper, like all true pepper seeds. It is a close relative of cubeb pepper and a relative of black pepper and long pepper, which is large and spherical in shape, Ashanti peppers are prolate spheroids, smaller and smoother than cubeb pepper in appearance and generally bear a reddish tinge. They are native to tropical regions of central and Western Africa and are semi-cultivated in countries such as Nigeria where the leaves (known as uziza) are used as a flavoring for stews (Klin-Kabari *et al*., 2011).

Like other members of the pepper family, Ashanti peppers contain 5-8% of the chemical "piperine" which gives them their 'heat'. They contain large amounts of beta-caryophyllene, which is being investigated as an anti-inflammatory agent. They also contain significant proportions (10%) of Myristicin, elemicin, safrole and dillapiol (Klin-Kabari *et al.,* 2011). Research has shown that they have preservative and anti-oxidant properties. (Klin-Kabari *et al.,* 2011).

2.0 Materials And Methods

Myristica fragrans, monodora myristica, *Piper guineense* and *Rosemarinus officinalis* were all purchased from the Umuahia-Town market (Isi-gate), in Abia State, Nigeria. All the test samples were identified by the appropriate authorities. The spices were procured in their dry state and ground to powder for the analysis.

The Moisture contents, Carbohydrate, Protein, crude fibre, and minerals were determined by appropriate methods described by (James, 1995).Total ash was determined by the incineration gravimetric method (AOAC, 1996). Fat content of the sample was determined by the continuous solvent extraction method described by Pearson (1976).The spectrophotometric method by (Onwuka, 2005) was employed in the vitamins content determination.Vitamin C content of the samples were determined by the Barakat titrimetric method (1973).

3.0 Result And Discussion

The proximate compositions of the samples studied are presented in table 1.

Table 1: The proximate compositions of *Myristica frangrans, Piper guineense, Monodora myristica* and *Rosmarinus officinalis*.

Proximate composition (%)	*Myristica frangrans*	*Piper guineense*	*Monodora myristica*	*Rosmarinus officinalis*
Moisture content	11.72^{c}±0.11	12.35^{b}±0.01	12.78^{a}±0.03	10.83^{d}±0.02
Dry matter	88.28^{b}± 0.11	87.65^{c}±0.01	87.22^{d}±0.03	89.16^{a}±0.02
Ash	9.84^{b}± 0.00	6.33^{c}±0.02	10.49^{b}±0.00	11.78^{a}±0.02
Crude fibre	12.52^{c}± 0.100	8.79^{d}±0.01	13.66^{b}±0.05	14.26^{a}±0.04
Crude fat	13.34^{a}±0.07	9.89^{b}±0.07	8.92^{c}±0.02	3.48^{d}±0.04
Crude protein	11.50^{b}±0.02	5.86^{d}±0.04	9.27^{c}±0.04	14.30^{a}±0.08
Carbohydrate	41.57^{d}±0.71	57.32^{a}±0.78	44.84^{c}±0.05	45.84^{b}±0.71

Values are means ± standard deviation of triplicate determinations. Values on the same row with different superscripts are significantly different (P≤0.05).

Table 2: The vitamin content of *Myristica frangrans, Piper guineense, Monodora myristica* and *Rosmarinus officinalis*.

Vitamins (Ug/g)	*Myristica frangrans*	*Piper guineense*	*Monodora myristica*	*Rosmarinus officinalis*
Vitamin A	14.57^{b}±0.177	7.08^{d}±0.00	13.71^{c}±0.12	14.87^{a}±0.10
Vitamin B_1	0.039^{b}± 0.00	0.029^{c}±0.00	0.034^{bc}±0.00	0.045^{a}±0.00
Vitamin B_2	0.022^{ab}± 0.00	0.16^{b}±0.00	0.018^{b}±0.00	0.025^{a}±0.00
Vitamin B_3	0.016^{b}± 0.00	0.009^{c}±0.00	0.013^{b}±0.00	0.019^{a}±0.00
Vitamin C	274.46^{c}±0.22	292.62^{b}±0.24	243.43^{d}±0.58	378.62^{a}±0.03

Values are mean ± standard deviation of triplicate determinations. Values on the same row with different superscripts are significantly different (P≤=0.05).

Table 3: The mineral content of *Myristica fragrans, Piper guineense, Monodora myristica* and *Rosmarinus officinalis.*

Minerals (Mg/100g)	*Myristica frangrans*	*Piper guineense*	*Monodora myristica*	*Rosmarinus officinalis*
Calcium	184.46^{c} ± 0.22	179.52^{d} ±0.11	189.53^{b} ± 0.12	192.31^{a}± 0.01
Magnesium	64.52^{c}± 0.31	35.54^{d} ±0.36	82.71^{b}± 0.014	85.66^{a}± 0.08
Potassium	334.78^{b}± 1.44	98.52^{d} ± 0.10	316.64^{c}± 0.21	343.82^{a}± 0.02
Sodium	42.80^{a}± 0.06	20.87^{d} ± 0.04	38.77^{c}± 0.09	41.46^{b} ±0.22
Phosphorus	235.56^{c}± 0.19	217.70^{d} ± 0.41	268.82^{b}± 0.02	274.62^{a}± 0.02
Iron	3.16^{c} ± 0.00	2.52^{d} ± 0.10	3.45^{b}± 0.00	3.76^{a}± 0.05

Values are means ± standard deviation of three determinations. Values on the same row with different superscripts are significantly different (P≤ =0.05).

4.0 Discussion

The results in table 1 showed that *Rosmarinus officinalis* had significantly (P<0.05) the lowest moisture content (10.38%) and highest ash, crude fibre and protein contents than *Myristica fragrans, Piper guineense* and *Monodora myristica*. Crude fibre content of *Mondora myristica* (13.66%) was significantly (P<0.05) higher than that of *Myristica fragrans* (12.52%) and *Piper guineense* (8.79%).The ash content of the other three spices were significantly (P<0.05) higher than that of *Piper guineense* (6.33%). Crude protein content of *Myristica fragrans* (11.5%) was significantly higher than *Monodora myristica* (9.27%) and *Piper guineense* (5.86%).*Myristica fragrans* had significantly (P<0.05) higher crude fat (13.34%) than other spices in table 1. This implies that *Myristica fragrans* in diet will promote fat –soluble vitamin absorption in the body. Fat is high energy nutrient and does not add to the bulk of the diet (Ekeanyanwu *et al.,* 2010).

The moisture contents of *Rosmarinus officinalis* (10.83%), *Myristica fragrans* (11.72%), *Piper guineense* (12.35%) and *Monodora myristica* (12.78%) were similar to the moisture content of other African spices such as *Uacapa guineense* (11.20%) and *Zanthoxyllus zanthoxyloides* (10.90%) as reported by Ogunka-Nnoka and Mepba (2008). However, the low moisture content of *Rosmarinus officinalis*, *Myristica fragrans, Piper guineense* and *Monodora myristica* is an indication of the fact that these spices can be stored for a long period without deterioration in quality (Ogunka-Nnoka and Mepba, 2008; Agomuo *et al.,* 2011). The crude protein and carbohydrate contents of *Piper guineense* (18.90% and 63.38%) were higher and agrees with the report of Isong and Essien (1996).

The ash and crude fibre content of *Rosmarinus officinalis* (11.78% and 14.26%), *Myristica fragrans* (9.84% and 12.52%), *Piper guineense* (6.33% and 8.79%) and *Monodora myristica* (10.49% and 13.66%) were higher than that of *Uacapa guineense* (1.7% and 0.80%) and *Zanthoxyllus zanthoxyloides* (1.30% and 1.40%) as reported by

Ogunka-Nnoka and Mepba (2008).

Rosmarinus officinalis had the highest ash content which is an indication of rich mineral content. The high fibre content of the spices especially *Rosmarinus officinalis* (with the highest crude fibre content: 14.26%) will have far reaching effects on human nutrition such as increase in faecal bulk and lowering of gastric cholesterol (Agomuo *et al.,* 2011) . Ekeanyanwu *et al*. (2010) reported that diet low in fibre is undesirable as it could cause constipation,such diets have also been associated with diseases of the colon like; pile, appendicitis and cancer.

Carbohydrate content of *Piper guineense* (57.332%) was significantly ($P<0.05$) higher than *Rosmarinus officinalis* (45.84%), *Monodora myristica* (44.84%) and *Myristica fragrans* (41.57). This is also an indication that *Piper guinense* could be a rich source of energy in diet. (Ekeanyanwu *et al.,* 2010).

Table 2 shows the vitamin content of the spices studied. All the four samples had vitamin A, vitamin B_1, vitamin B_2, vitamin B_3 and vitamin C. Vitamin A and vitamin B_2 contents of *Rosmarinus officinalis* were significantly higher than that of *Piper guineense* and *Monodora myristica* and also higher than vitamin A content of *Myristica fragrans*.

Rosmarinus officinalis (0.045 mg/100g) had significantly ($P<0.05$), higher vitamin B_1 content followed by *Myristica fragrans* (0.039 mg/100g), *Monodora myristica* (0.034 mg/100g) and *Piper guineense* (0.029) mg/100). Vitamin B_3 and vitamin C content of *Rosmarinus officinalis* were significantly ($P<0.05$) higher than that of *Piper guineense, Monodora myristica* and *Myristica fragrans*.

Ekeanyanwu *et al.* (2010) reported that vitamin A, C, calcium and protein are involved in bone formation, this means that consumption of these spices will be good for strong bone especially *Rosmarinus officinalis* with highest content of vitamins A and C.

Vitamin B_3 of *Myristica fragrans (*0.016 mg/100g) was significantly ($P<0.05$) higher than that of *Piper guineense* (0.009 mg/100g) and *Monodora myristica* (0.013 mg/100g) while vitamin C of *Piper guineense* (292.62 mg/100g) was significantly ($P<0.05$) higher than *Monodora myristica* (243.43 mg/100g) and *Myristica fragrans* (274.46 mg/100g). *Rosmarinus officinalis* is highly rich in B-complex vitamins and vitamin C more than *Monodora myristica, Myristica fragrans* and *Piper guineense*, its inclusion in diet could be good source of anti-oxidants and enough vitamins for formation of enzymes that are essential for optimum health (Ekeanyanwu *et al.,* 2010).

The results in table 3 showed that calcium, magnesium and potassium contents of *Rosmarinus officinalis* were significantly ($P<0.05$) higher than that of *Piper guineense, Monodora myristica,* and *Myristica fragrans.* Calcium and magnesium content of *Monodora myristica* (189.53 mg/100g and 82.71 mg/100g) were significantly ($P<0.05$) higher than that of *Piper guineense* (179.52 mg/100g and 35.54 mg/100g) and *Myristica fragrans* (184.46 mg/100g and 64.52 mg/100g) while potassium content of *Myristica fragrans* (334.78 mg/100g) was significantly ($P<0.05$) higher than that of *Piper guineense* (98.52 mg/100g) and *Monodora myristica* (316.64 mg/100g) respectively.

Sodium content of *Myristica fragrans* was significantly ($P<0.05$) higher than that of *Piper guineense* and *Monodora myristica* while *Rosmarinus officinalis* had significantly ($P<0.05$) higher phosphorus and iron (Fe) contents than the other spices. This agrees with the report by Ekeanyanwu *et al.* (2010) compared to the report of Isong and Essien (1996).

The ratio of sodium to potassium in the body is of great important for prevention of high blood pressure, this indicates that *Rosmarinus officinalis* and *Myristica fragrans* in the diet would probably reduce high blood pressure since *Rosmarinus officinalis* and *Myristica fragrans* had the highest sodium and potassium contents. Also, since *Rosmarinus officinalis* had significantly higher calcium and magnesium, it will be useful in blood clotting, muscle contraction, maintenance of the electrical potential in nerve cells, and in many enzymes activation in the metabolic process (Isong and Essien, 1996; Ekeanyanwu *et al.,* 2010)

The spices discussed above namely: *Myristica frangrans, Piper guineense, Monodora myristica* and *Rosmarinus officinalis* are commonly used spices in Nigerian delicacies and also used for their medicinal properties (Hannah and Parameswari, 2010).

The nutritional compositions of the above spices have been evaluated by chemical analyses. *Rosmarinus officinalis* is nutritionally rich containing 14.30% crude protein, 14.26% crude fibre, 11.78% ash, 89.16% dry matter and 45.84% carbohydrate. The spices are good sources of carbohydrate, thus contributes to the energy generation for cellular activities. The vitamin content of *Rosmarinus officinalis* were higher than the rest three spices. All the spices discussed are very rich in vitamins A and C.The minerals: calcium, magnesium, sodium, potassium and phosphorus were present in the samples at high amounts. The samples have shown low contents of iron.Based on the fact that the spices evaluated serve as good sources of carbohydrate, their consumption will go a long way in contributing to the energy generation required for metabolic reactions of the cells. Also their consumption is very important as it go a long way in formation of strong bone due to their high contents of vitamins A and C, calcium and proteins (Ekeanyanwu *et al.,* 2010).The consumption of the samples especially *Rosmarinus officinalis* and *Monodora myristica* should be increased as they have the highest ash content which is an indication of higher mineral content since the body uses minerals for many cellular activities.

From this research, *Rosmarinus officinalis* has particularly proved to be an excellent spice in terms of nutrition; every family is advised to include it in their stock of spices.

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