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Lesser known spices of Akwa Ibom State; their nutritional, antinutritional, mineral and phytochemical analyses

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ABSTRACT

A random investigation of indigenous spices used by the people of Akwa Ibom State revealed a total of eight spices of which four (Monodora myristica (Gaertner) Dunal Chrysobalanus atacorensis A. Chev., and Xanthosoma maffafa (L.) Schum. are being documented for the first time. The seed, fruit, and spathes respectively are the plant parts used as spices. These were analyzed and the proximate composition showed that protein was 16.14%, 15.74%, and 4.82% respectively for M. myristica, C. atacorensis, and X. maffafa. Crude fat was 37.11%, 12.22%, and 12.01% respectively. Ash content was 5.33%, 2.00% and 14.00%. Fibre was 19.00%, 7.33%, and 29.00%. Carbohydrate was 22.75%, 62.69%, and 40.17%. The moisture content was 85.50%, 91.00%, and 92.38%. Mineral composition for the 3 spices were as follows: Potassium-1960.00 mg/kg , 2490.00 mg/kg, and 3965 mg/kg. Sodium – 113.33 mg/kg, 96.66 mg/kg, and 2231 mg/kg. Magnesium-190.33 mg/kg, 165.33mg/kg and 451.6 mg/kg. Calcium –642.66 mg/kg, 324.00 mg/kg, and 931.00 mg/kg. Phosphorous – 3000.00 mg/kg, 3250.00 mg/kg and 3460.00 mg/kg. Iron – 508.74mg/kg, 504.57mg/kg, and 291.90mg/kg. The ant-nutrient composition in mg/100g for phytic acid was 39.45, 31.44, and 3.31 in the three spices. Oxalic acid was 88.00, 97.09, and 30.80, while the composition of tannic acid was 7.34mg/100g in M. myristica, absent in C. atacorensis and 4.97mg/100g jn X. maffafa. The phytochemical screening revealed that saponins were strongly present in M. myristica but absent in the other three spices. Tannins were strongly present in M. myristica, present in X. maffafa but absent in C. atacorensis. Anthraquinones were absent from all three spices. Flavonoids were strongly present in C. atacorensis and present in the other two spices. Cardiac glycosides were strongly present in M. myristica and C. atacorensis, but occurred in trace amounts in X. maffafa. Alkaloids were present in M. myristica , strongly present in C. atacorensis and absent in X. maffafa. These spices are highly recommended for consumption and conservation.

Key Words: Indigenous, spices, nutrient, anti-nutrient, phytochemical, conservation

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INTRODUCTION

Spices are plant products used in flavouring foods and beverages [1].They have nutritional value and are often referred to as food accessories or adjuncts because of their ability to stimulate appetite and increase the flow of gastric juice [2] . Each spice has a unique aroma and flavor which derive from compounds known as phytochemicals [3]. In addition to their usage in cooking, individual spices and blends are used as colouring agents, brain stimulants and aphrodisiacs[4].

Spices improve the palatability and the appeal of dull diets. They stimulate salivation and therefore promote digestion [5]. He also observed that the essential oils and terpenoid alcohol of spices contribute to their smell, taste and tactile sensation, that mostly spicy herbs have traditional medical values. Such spices could be regarded as digestants, carminatives and bowel function improvers. Some spices according to him are used in aromatherapy, resulting in relaxation and calmness.

Some common spices used by the people of Akwa Ibom State include; *Tetrapleura tetraptera*, (uyayak) *Piper guineense* (odusa), *Gongronema latifolium (*utasi), *Aframomum melegueta*, (ntuen ibok), *Xylopia aethiopica* (ata), *Occimum gratissimum* (ntong), *O. canum* (iko). Each spice has a unique aroma and flavor which derive from compounds known as phytochemicals or secondary metabolites. These chemicals evolve in plants to protect them against herbivorous insects, fungi, pathogens and parasites [3]. According to [6] most indigenous African spices like *Aframomum melegueta, Aframomum citratum, Piper guineense* and *Xylopia aethiopica* are often advantageously used as low cost eco-friendly, low risk pesticidal alternatives to the conventional synthetic pesticides.

Some of the spices that are no longer popularly used include; the seed of *Monodora myristica* (inwun*)*, *Chrysobalanus atacorensis* (eyim eto), *Diplazium sammattii* (nyama idim) and the spathes of *Xanthosoma mafaffa*, and *Colocasia esculenta*. The spathes of *Xanthosoma mafaffa* were also reportedly used by the Igbos for yam pepper soup.

Mondora myristica belongs to the family Annonaceae. It is a tree up to 18m with alternate, exstipulate leaves. Flowers are large and fragrant, the carpels are in a single whorl and the ovary is single celled. Petals are in 2 series with the outer petals being larger lobed and often with wavy margins. The inner petals are smaller, broadly ovate and shortly clawed. The fruit is spherical and green. The seeds are often powdered and used for preparing stew and soups.

Chrysobalanus atacorensis belongs to the family Rosaceae. It is a small tree with leaves that are oblong elliptic, acuminate and cuneate at base. The flowers are hermaphrodites, actinomorphic and arranged in cymes. Petals are present. Fruits are ribbed and pubescent when young [7]. Dried fruits are powdered and used as meat tenderizer and in pepper-soup and other local delicacies.

Xanthosoma mafaffa is a robust herb up to 2m high. The underground stem- a corm,is up to 25cm long, flask shaped and broadened towards the apex. Large stalked leaves aris from the apex of the corm. The leaves are sagittate, with stout petioles up to 1m in length. The inflorescence is borne in the spathe which is about 20cm long. The female flowers also occur at the base of the spadix while male flowers occur above as in *C. esculenta*. However, there is no sterile terminal portion [8].

The purpose of this work was to investigate the nutritional and anti-nutritional properties and the mineral composition as well as photochemical constituents of these lesser known spices.

MATERIALS AND METHOD

The materials used for this work were obtained as follows: *Monodora myristica* (Gaertner) Dunal was collected from Itiukho in Ibiono Local Government Area , *Chrysobalanus atacorensis* was collected from Mbak Etoi in Uyo Local Government Area. Fresh spathes of *Xanthosoma mafaffa* were collected from Ekamba Nsukara, Nwaniba in Uyo Local Government Area respectively in Akwa Ibom State. Voucher specimens of all samples were deposited in the University of Uyo Herbarium.

The dried seeds of *M. myristica* and *C. atacorensis* were reduced to powdered form , stored in airtight containers, labeled and kept in the refrigerator prior to analysis. This was also done for the dried spathes of *C. esculenta* and *X. mafaffa.*

200g each of powdered seeds sample was extracted using 96% ethanol and distilled water while 10g each of the powdered spathes were extracted using 96% and 50% ethanol and distilled water respectively. The mixtures were allowed to stand for 72 hours after which the mixture was filtered and filtrate was concentrated to dryness in vacuo at 45^0C. The dried extract was then used for phytochemical screening according to the method of [9] and[10].

The proximate analyses was done using the micro Kjeldahl method of [11] for the crude protein determination. The lipid was extracted by exhaustive extraction of a known weight with petroleum ether (boiling point of 40^0- 60^0C) using a soxhlet apparatus [12]. Crude fiber was obtained by digesting fat free sample with 1.25% H_2SO_4 (w/w) and 1.25% NaOH (w/w) respectively, then dried in an oven at 100^0 C and weighed. The crude fiber was obtained by the difference in weight of the material in a furnace at 550^0C for 24 hrs and the difference in weight before and after was regarded as the organic matter.

The anti-nutritive contents of the samples were determined using [13] method for oxalates and [14] method for phytates.

The elemental analysis was done using a UNICAM 939 AA spectrophotometer in the determination of potassium, sodium, magnesium and calcium at indifferent wavelength. Phosphorus and iron were also determined according to[15] Jackson (1996).

RESULTS

The results of the analyses done on the seed samples of *Monodora myristica* and *Chrysobalanus atacorensis* as well as the spathes of and *Xanthosoma mafaffa* are summarized in tables 1-4.

Table 1: Nutrient Composition (in %) of *M. Myristica, C. Atacorensis* and *X .Mafaffa*

Nutrients	***M. myristica***	***C.atacorensis***	***X. mafaffa***
Protein	16.14 ± 0.04	15.74 ± 0.04	4.82 ± 0.80
Fat	37.11 ± 0.34	12.22 ± 0.19	12.01 ± 0.64
Fiber	19.00 ± 1.00	7.33 ± 0.57	29.00 ± 0.24
Ash	5.33 ± 0.57	2.00 ± 1.00	14.00 ± 0.50
Carbohydrate	22.75 ± 1.20	62.69 ± 0.47	40.17 ± 0.88
Moisture	85.50 ± 0.50	91.00 ± 0.50	92.38 ± 1.00

Table 2: Anti-Nutrient Composition

Anti-nutrients	***M. myristica***	***C. atacorensis***	***X. mafaffa***
Phytic acid	39.45 ± 0.20	31.44 ± 0.10	3.31±0.30
Oxalic acid	88.00 ± 0.88	97.09 ± 0.50	30.80 ± 0.20
Tannin	7.34 ± 0.01	-	4.97 ± 0.05

Table 3: Mineral Composition of The Three Samples (mg/kg)

Mineral	***M. myristica***	***C.atacorensis***	***X. mafaffa***
Potassium	1960.00±138.56	2490.00±86.66	3965.00±5.00
Sodium	113.33 ± 5.77	96.66±5.77	2231.00±29.00
Magnesium	190.33 ± 2.88	165.33±2.51	451.60±0.60
Calcium	642.66 ± 4.61	324.00±4.00	931.00 ± 1.50
Phosphorus	3000.00± 0.00	3250.00 ± 0.00	3460.00 ± 3.08
Iron	508.74 ± 0.00	504.57± 0.00	291.90 ± 0.60

Table 4: The Result of Phytochemical Screening

TEST	***M.myristica***	***C. atacorensis***	***X. mafaffa***
Saponins (Frothing Test)	+++	-	-
Tannins (Ferric Chloride Test)	+++	-	++
Anthraquinones	-	-	-
Flavonoids (Shinoda's Test)	++	+++	++
Cardiac glycosides			
Lieberman's Test	+++	+++	-
Salkowski's Test	++	+++	+
Keller-Killiani's Test	+++	+++	+
Phlobatannins	-	++	-
Alkaloids	++	+++	-

Key: +++ =Strongly present; ++ = Present; + = Trace; = Absent

DISCUSSION

In Table 1, the nutrient /proximate analyses showed that crude protein was highest in *M. myristica* (16.4%) and lowest in *X. maffafa* (4.82%). However these values are in line with the range given by [16] for spices and herbs (i.e. 4.6-22.7%) in their work. The value for crude fat in *M. myristica* (37.11%) however, is higher than the range provided in [16] findings which was 7.50-36.00%. Crude fibre was highest in *X. maffafa* (29%) and least (7.33%) in *C. atacorensis*. Fibre is known to impair the bioavailability of several minerals according to [17], increased fibre intake in humans promotes health by promoting normal elimination of waste products of digestion. It also promotes satiety and helps control serum cholesterol. The ash content in *X. maffafa* was higher (14%) than the other two spices where it was 5.33% in *M. myristica* and 2.00% in *C. atacorensis*. Ash content is a function of the soil content on which the plants are grown. The ash content values for *X. maffafa* and *C. atacorensis* are beyond the range of values given by [18], in their work which was 4.06%- 8.48%.The carbohydrate content was highest in *C. atacorensis* (62.69%), followed by *X. maffafa* with 40.17% and the least was *M. myristica* with 22.75%. In their work [16] gave a range of 34.6%-41.90% for carbohydrates in spices and herbs but the value for *M. atacorensis* in this work was beyond their range. Moisture content was 85.50%, 91.00% and 92.38% in *M. myristica, C. atacorensis* and *X. maffafa* respectively. The latter is more succulent because it is leafy and the first two are seeds.

Table 2 shows the composition of anti-nutrients in the spices. Phytic acid was highest (39.45mg/100g) in *M. myristica* and least (3.31mg/100g) in *X. maffafa*. Phytic acid contributes to mineral deficiency in people whose diets rely on certain foods for their mineral intake, and for people with low intake of essential minerals such as young children and those in developing countries. This is an undesirable effect [19]. Phytic acid also provides anti oxidant effects and may prevent and cure colon cancer.

Oxalic acid was more (97.09mg/100g) in *C. atacorensis* and least (30.80mg/100g) in *X. maffafa*. Consumption of oxalate- rich plants may result in kidney disease or even death [20]. Compared with their results on the Araceae (234-411mg/100g), the values obtained for these spices are low. Tannins were found in both *M. myristica* and *X. maffafa* although more so (7.34mg/100g) in the former than the latter (4.97mg/100g), and absent in *C. atacorensis*. According to [18], the LD_{50} of tannic acid is about 500mg/kg. This value is much higher than the values obtained from the spices in this work. Ingestion of tannic acid slows down the absorption of iron and other trace minerals [21]. In spite of their occurrence, the spices are safe for consumption and *X. maffafa* could be said to be the safest having the least values of the anti-nutrients

Table 3, shows the mineral composition of the spices. Potassium, Sodium, Magnesium, Calcium, and Phosphorus content was highest in *X. maffafa* (3965.00 mg/kg, 2231.00mg/kg, 451.60mg/kg, 931.00mg/kg, and 3460.00mg/kg, respectively). However iron content was highest (508.74mg/kg) in *M. myristica.* According to [22], minerals are important in maintenance and regulation of the physical properties of biological systems. They are also important in the maintenance of the acid-base equilibrium and they are an essential part of enzyme system. Spathes of *X. maffafa* are therefore a good source of minerals for the body.

As seen in Table 4, saponins were strongly present only in *Monodora myristica* but absent in both *Chrysobalanus atacorensis* and *Xanthosoma mafaffa*. This implies that *M. myristica* has cholesterol lowering properties and some deleterious (cytotoxic-permeabilization of the intestine) properties according to [23]. Saponins have also been found to increase and accelerate the body's ability to absorb calcium and silicon according to [24]. Anthraquinones were absent from all the three spices investigated. Flavonoids were present in all three but *C. atacorensis* only, had a strong presence of the flavonoids. The implication of this is that, these spices may have anti-allergic, anti-inflamatory, anti-microbial and anti-cancer properties. According to [25], flavonoids have been referred to as nature's response modifiers because of strong experimental evidence of their ability to modify the body's reaction to allergens, viruses and carcinogens.

Cardiac glycosides were strongly present in both *M. myristica* and *C. atacorensis* but occurred in trace amounts in *X. maffafa*. [22] stated that cardiac glycosides were effective in treating a heart disease by increasing the blood pressure which in turn increases the efficiency of the kidneys. These spices therefore, are good for those with heart disease.

Phlobatannins were present only in *C. atacorensis* and absent in the other two spices.

Alkaloids were lacking in *X. maffafa*, present in *M. myristica* and strongly present in *C. atacorensis*. Many alkaloids are known to be of medicinal value to man [26] As a result, these spices may also perform medicinal functions in the body when consumed either in food or as herbal concoctions.

CONCLUSION AND RECOMMENDATION

In conclusion, these lesser known spices have been found to be rich in nutrients minerals and secondary metabolites. The latter account for the medicinal usefulness of these spices. Although they have anti-nutrients their values are too small to be harmful.

We recommend that these spice plants be brought more into cultivation in a bid to conserve them since apart from *X. maffafa*, the other 2 spices are still collected in the wild. It is also recommended that these spices be produced for wider consumption. They also have potentials as drug sources for the pharmaceutical industry.

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