

Chemical Composition and Physicochemical Properties of Selected Seed Spices in Ibadan Metropolis, Nigeria

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Abstract: *Monodora myristica* (African nutmeg), *Myristica fragrans* (nutmeg) and *Byrosocarpus dinklayer* (Efu) are common spices used in the preparation of delicacies. The proximate composition of the seed flour and physicochemical properties of the oil were determined. The purpose of this study was to evaluate the chemical composition of the seed flours and physicochemical properties of the oil in order to know their domestics and industrial applications. The oil of *M. myristica*, *M. fragrans* and *B. dinklayer* were extracted with petroleum ether. The moisture, dry matter, crude fibre, fat, protein, ash and carbohydrate contents for *M. myristica*, *M. fragrans* and *B. dinklayer* ranged from 11.76-13.67, 88.24-89.30, 13.60-15.47, 5.28-14.65, 7.90-10.41, 9.20-11.45 and 40.78-47.13% respectively. The acid values of *M. myristica*, *M. fragrans* and *B. dinklayer* were 0.70, 0.68 and 0.98 g/100g respectively. The values for oil under study suggested its edibility. The iodine values were 93.27, 89.30 and 106.72 g/100g respectively. Since the iodine values of the oil are lower than 100 (gI₂/100 g sample) except *B. dinklayer*, the oils could be classified as non-drying oils. The peroxide values were 8.90, 5.12 and 9.60 g/100g respectively. The values indicate low levels of oxidative rancidity. The saponification values ranged from 179.03-188.64. The values suggested that the oils may be used in soap and shampoos.

Keywords: Common spices, Fragrance, Soxhlet extraction, Saponification, Crude fibre

I. Introduction

Monodora myristica has the common names of African nutmeg and Calabash nutmeg and in Nigeria, it is called “Ehuru” in Igbo, “Abolakoshe” in Yoruba and “Ebenoyoba” in Benin. In traditional medicine, the bark, seeds and leaves of the plant are used in treating various ailments. However, most economically important parts of the plants are the seeds which are embedded in the white, sweet-smelling pulp of the sub-spherical fruit. The seeds have nutritive and calorific values that make them essential in diets [1].

Myristica fragrans (nutmeg) is a common spices used in the preparation of several delicacies.

Myristica fragrans, which belong to Myristiceae family is native to spice island near Indonesia, and is used as spices in several parts of the world [1]. *Myristica fragrans* has a distinctive pungent fragrance and a warm slight sweet taste. It is used as flavor in the preparation of several foods [1, 2]. Nutmeg (*Myristica fragrans*), African nutmeg (*Monodora myristica*) and Efu (*Byrosocarpus dinklayer*) seeds are commonly used as spices and food flavour in Ibadan. The seeds are readily available in all their markets in the city.

Considering the extensive use of nutmeg, African nutmeg and Efu in food, beverages and medicine, then research was conducted on the crude fibre, crude fat, total ash, crude protein, carbohydrate, acid value, iodine value, peroxide value and saponification value of *Monodora myristica*, *Myristica fragrans* and *Byrosocarpus dinklayer* seeds. The three spices (*Monodora myristica*, *Myristica fragrans* and *Byrosocarpus dinklayer* seed) are under-utilized in Nigeria and their nutritional values has been

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fully investigated [2]. Thus, this research work is focused on the chemical composition of the seed flours and physico-chemical properties of the oil extracted from them in order to know their domestics and industrial applications.

II. Materials and Methods

A. Sample Collection and Preservation

The samples were purchased from a popular market within Ibadan metropolis in Oyo State, Nigeria. The samples were dehusked and dried in an air-circulating oven at a temperature of about 100 °C and ground into fine powder. The powder of each sample was sieved and stored in air-tight containers. It was kept in the refrigerator until required for analysis.

B. Proximate Analysis

Moisture content was determined by drying the seeds to a constant weight at 100 -107 °C in an Oven, (%) ash content by Ignition at 550 °C in a muffle furnace for 4hours, oil content by Soxhlet extraction with hexane as a solvent, protein by kjeldahl method and crude fibre by the acid and alkaline digestive methods and all described by [3]. The carbohydrate content was estimated by difference, subtracting the sum of water, protein, fat, crude fibre and ash percentages from one hundred [4].

C. Oil Analysis

Peroxide value was evaluated according to [4, 5]. The saponification value was determined according to the titrimetric method of [6]. Iodine value was determined according to wij's method of [7, 5]. Acid value was determined by titrimetric method of Pearson (1970) [7, 5].

III. Results and Discussion

The proximate composition Table 1 of the samples analyzed showed that *Myristica fragrans* had the lowest moisture content (10.70%) and highest crude fat than *Monodora myristica* and *Byrosocurpus dinklayer*. The crude fibre content

of *Byrosocurpus dinklayer* (15.47%) was considerably higher than that of *Myristica fragrans* (13.49%) and *Monodora myristica* (13.60%). The ash content of the other two spices were significantly higher than that of *Byrosocurpus dinklayer* (8.87%). The crude protein content of *Byrosocurpus dinklayer* (11.45%) was significantly higher than *Monodora myristica* (9.20%) and *Myristica fragrans* (10.98%). *Myristica fragrans* had significantly higher crude fat (14.65%) than other spices in table 1. This indicates 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 [2].

The moisture contents of *Myristica fragrans* (10.70%), *Monodora myristica* (11.76%) and *Byrosocurpus dinklayer* (13.67%) were similar to the moisture content of other African spices such as *Uacapa guineense* (11.20%) and *Zanthoxylus zanthoxylodes* (10.90%) as reported by [8]. However, the low moisture content of *Myristica fragrans*, *Monodora myristica* and *Byrosocurpus dinklayer* is an indication of the fact that these spices can be stored for long period without deterioration in quality [8, 9, 10]

Monodora myristica had the highest ash content which is an indication of rich mineral content. The high fibre content of the spices especially *Byrosocurpus dinklayer* (with the highest crude fibre content: 15.47%) will have far-reaching effects on human nutrition such as an increase in faecal bulk and lowering of gastric cholesterol [9, 2] 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.

The Carbohydrate content of *Monodora myristica* (47.13%) was significantly higher than *Byrosocurpus dinklayer* (45.26%) and

Myristica fragrans (40.78%). This is also an indication that *Monodora myristica* could be a rich source of energy in diet [2]. The physicochemical properties in Table 2 of the sample analyzed showed that *Byrosocarpus dinklayer* has the highest Acid value with 0.98 g/100g and *Myristica fragrans* has the lowest with 0.70 g/100g. Therefore, the values obtained are lower when compared with the report of [11] (19.04 mgKOH/g) for *Plukenetia conophora*. The acid value can be used to check the level of oxidative deterioration of the oil by enzymatic oxidation.

Table 1: Proximate Composition (%) of the Three Different Types of Spices.

% Proximate Composition	African nutmeg (<i>Monodora myristica</i>)	Nutmeg (<i>Myristica fragrans</i>)	Efu (<i>Byrosocarpus dinklayer</i>)
Moisture content	11.76±0.04	10.70±0.15	13.67±0.07
Dry matter	88.24±0.04	89.30±0.15	86.33±0.07
Crude Fibre	13.60±0.05	13.49±0.80	15.47±1.50
Crude fat	7.90±0.02	14.65±0.07	5.28±0.74
Total Ash	10.41±0.01	9.40±0.50	8.87±0.05
Crude protein	9.20±0.02	10.98±0.08	11.45±0.15
Carbohydrate by difference	47.13	40.78	45.26

Values are means± standard deviation of triplicate determination.

Table 2: Physicochemical properties (g/100g) of the oils of the three different types of spices.

Parameters (g/100g)	African nutmeg (<i>Monodora myristica</i>)	Nut (<i>Myristica fragrans</i>)m eg	Efu (<i>Byrosocarpus dinklayer</i>)
Acid value	0.70±0.03	0.68±0.04	0.98±0.01
Iodine value	93.27±1.45	89.30±3.24	106.72±1.17
Peroxide value	8.90±0.74	5.12±0.80	9.60±0.50
Saponification value	188.64±2.29	179.03±3.45	194.25±1.09

Values are means± standard deviation of triplicate determinations.

The acid value is expected to range from 0.00 – 3.00mgKOH/g oil before it can find application in cooking and the values obtained for oil under study indicated that it is suitable for cooking. The Iodine value ranged from 89.30 g/100g in *Myristica fragrans* to 106.72 g/100g in *Byrosocarpus dinklayer*. Higher values show increase in the average degree of unsaturation of the oil, as such, the oil is susceptible to oxidative rancidity. As a result of their agreement with standard, all the oils could be classified as non-drying oils; since their iodine values are lower than 100 (gI₂/100 g sample) except for *Byrosocarpus dinklayer*. However, those oils whose values are less than 100 (gI₂/100 g sample) could be used as lubricants and hydraulic brake fluids [12].

Peroxide value ranged from 5.12 g/100g in *Myristica fragrans* to 9.60 g/100g in *Byrosocarpus dinklayer*. The peroxide values are in all cases very low. The low values of peroxide are indicatives of low levels of oxidative rancidity of the oils and also suggest high levels of antioxidant [12]. Certain antioxidants may be used to reduce rancidity. The saponification values ranged from 179.03±3.45 g/100g in *Myristica fragrans* to 194.25±1.09 g/100g in *Byrosocarpus dinklayer*.

The saponification values were found to be high. These show that more alkali would be required to enable it to neutralize the available free fatty acid liberated by the oil. Therefore, the oils with saponification values in the range reported above may be used for soap making, shampoos and leather shaving creams [11]. Saponification values had been reported to be inversely related to the average molecular weight of the fatty acids in the oil fractions. Oil fractions with saponification values of 200 mgKOH/g and above, had

been reported to possess low molecular weight fatty acids [10, 12].

IV. Conclusion

African nutmeg (*Monodora myristica*), Nutmeg (*Myristica fragrans*) and Efu (*Byrosocarpus dinklayer*) seeds are good sources of crude fat, protein and carbohydrate. Consumption of these spices in diets would reduce the occurrence of nutritional deficiencies and their health problems. The physicochemical analysis revealed that the parameters were all within the standard values for edible oils. It can be used for domestics and industrial applications such as soap making, shampoos and leather shaving creams.

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