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Research Article

Determination of Proximate and Mineral Composition of Three Traditional Spices

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Abstract

Proximate and mineral compositions of three selected traditional spices (*Zingiber officinale, Allium sativum,* and *Monodora myristica*) were evaluated in this study. Disease-free samples of garlic, ginger and African nutmeg were bought from a local market at Ekpoma in Southern Nigeria. The samples were respectively peeled, and grinded to a desirable texture. Wet samples were analysed for the proximate composition and mineral contents. From the results, moisture, ash, crude protein, fat, fibre and carbohydrate content of ginger were 72.20, 0.81, 8.91, 11.71, 1.38, and 2.01% respectively; that of garlic were 59.90, 0.94, 12.41, 6.13, 1.95, 18.53% respectively while African nutmeg had 8.14, 1.39, 13.57, 46.48, 27.39, and 3.06% respectively. More so, sodium, zinc, iron, and calcium were 7.32, 4.99, 9.68, and 182.67mg/100g respectively in ginger, 9.41, 1.89, 8.47, 1016mg/100g in garlic. In African nutmeg, it was found to be 110.20, 135.91, 147.28, and 166.10mg/100g respectively. Consequently, ginger, garlic, and African nutmeg possessed varying proportions of the proximate components as well as mineral elements. However, African nutmeg possessed better moisture, ash, crude protein, crude fat, and crude fibre contents with a higher sodium, zinc, and iron mineral contents compared to other spices examined while garlic had a better carbohydrate and calcium levels.

Keywords: Garlic; Ginger; African Nutmeg; Proximate; Mineral

Introduction

Zingiber officinalis Roscoe, commonly known as ginger belongs to family Zingiberoside's cultivated commercially in India, China, South East Asia, West Indies, Mexico and other parts of the world. It is consumed worldwide as a spice and flavouring agent and is attributed to have many medicinal properties (Ghosh., *et al*. 2011).

Garlic (*Allium sativum*) is specie of the onion family and is used as flavouring in cooking and pickling, sometimes in the form of whole or grated cloves and sometimes in the form of a cooked extract, as in sauces and dressing. It has a characteristic pungent spice flavour that mellows and sweetens considerably with cooking. Locally, in Nigeria garlic is often paired with ginger to make stews and soups. Generally, garlic is used as supplement and on preparation of baked goods, puddings, gravies, soups, stew, meat products, non-alcoholic beverage and soft candy. In medicine, garlic is used as a digestive stimulant, diuretic and anti-spasmodic [1].

Monodora myristica belongs to the Annonaceae family and is one of the most important trees of the evergreen forest of West Africa (Burubai., *et al.* 2007). It is native to Nigeria, where the seed is called *ehuruorehirorabo-lakoshe* among the Yorubas. Its seeds are a popular spice used in cooking to flavour and thicken dishes. Medicinally, the root is chewed to relieve toothaches and arthritis. It is also used in treatment of anaemia, haemorrhoids and sexual weakness (Erukainure., *et al*. 2012). This study will therefore contribute to the knowledge about the nutrient contents of these traditional spices.

Materials and Methods

Collection and preparation of samples

Samples of traditional spices – garlic, ginger and African nutmeg were bought from a local market at Ekpoma, Esan West local government area, Edo state, Nigeria. The samples were fresh, viable, and free from disease. The samples were identified and authenticated at the Department of Botany by a Plant taxonomist. After which, the samples were properly preserved at the Laboratory of the Department of Biochemistry, Ambrose Alli University, Ekpoma. The samples were peeled using a laboratory knife and grinded using a wooden mortar to get a desirable texture. This was done for the three samples respectively. The grinded wet samples were further analysed for their proximate compositions at the Department of Animal Production and Health Nutrition Laboratory, Federal University of Technology, Akure.

Proximate chemical composition

Proximate composition was determined by standard procedures [2].

Determination of mineral content of sample

Mineral content of the different traditional spice samples was assessed following the method of Pearson., et al. (1981). About 1.5g of the sample was ignited in a Muffle furnace for 6 hours at 550ºC and the resulting ash was cooled in a desiccator after which, 0.1M HCl solution was added to break up the ash. It was then filtered through acid and washed with Whatman paper No. 1 into 100ml volumetric flask, and diluted to 100ml with distilled water.

The solution was analysed for some metals with different hollow cathode lamps for calcium (Ca), iron (Fe), and zinc (Zn) using an atomic absorption spectrophotometer (Jenway, FPSP 210) while sodium (Na) content was determined using a Flame Photometer (Jenway, PFP7).

Statistical analysis of data

The data obtained in this study were subjected to one-way analysis of variance (ANOVA) analysis with Tukey HSD post hoc test using IBM SPSS statistical software (version 23). Results were recorded as mean ± standard determination of two-repeated determinations. For statistical comparison, results are presented to be statistically significant when p values are less than 0.05 ($p < 0.05$).

Results

Parameters	Traditional Spices		
	Ginger	Garlic	African nutmeg
Moisture (%)	$75.20^a \pm 0.53$	$59.90^b \pm 0.24$	$8.14^c \pm 0.02$
Ash (%)	$0.81^c \pm 0.01$	$0.94^b \pm 0.01$	$1.39^a \pm 0.01$
Crude protein	$8.91^c \pm 0.04$	$12.41^b \pm 0.04$	$13.57^a \pm 0.09$
Crude fat (%)	$11.71^b \pm 0.19$	$6.13^c \pm 0.18$	$46.48^a \pm 0.12$
Crude fibre (%)	$1.38^b \pm 0.50$	$1.95^b \pm 0.23$	$27.39^a \pm 0.11$
CHO (%)	$2.01^c \pm 0.23$	$18.53^a \pm 0.34$	$3.06^b \pm 0.08$

Table 1: Proximate Composition of Ginger, Garlic, and African Nutmeg.

Data is presented as Mean ± Standard Deviation of duplicate determinations; mean values with different alphabets within the same row are statistically ($p<0.05$) significantly different; CHO = carbohydrate content

Mineral contents	Traditional Spices		
	Ginger	Garlic	African nutmeg
Sodium (mg/100g)	$7.32^c \pm 0.02$	$9.41^b \pm 0.02$	$110.20^a \pm 0.04$
Zinc (mg/100g)	$4.99^c \pm 0.04$	$1.89^b \pm 0.02$	$135.91^a \pm 0.24$
Iron (mg/100g)	$9.68^b \pm 0.02$	$8.47^c \pm 0.01$	$147.28^a \pm 0.03$
Calcium (mg/100g)	$182.67^b \pm 0.04$	$1016^a \pm 0.03$	$166.10^c \pm 0.33$

Table 2: Mineral Content of Ginger, Garlic, and African Nutmeg.

Data is presented as mean ± standard deviation of duplicate determinations; mean values with different alphabets within similar rows are statistically ($p<0.05$) significantly different.

Discussion and Conclusion

The proximate and some mineral compositions of three different traditional spices – garlic, ginger (Ziniger), and African nutmeg (*Monodora myristica*) were investigated in this study and results of the observations are summarised in Tables 1 and 2 respectively. From Table 1, the moisture content of *Monodora myristica* (African nutmeg) (8.14%) was significantly ($p < 0.05$) lower compared to those of ginger and garlic. In spite of this, the observed moisture content of African nutmeg in this study was higher than the 3.48% noticed by Enwereuzoh., *et al.* [3]. Moisture content of any food is an index of its water activity and is used as a measure of stability and susceptibility to microbial contamination [4]. Ginger and garlic however possessed highest moisture contents than other components (Table 1). Therefore, the low moisture content in African nutmeg compared to other traditional spices is indicative of the fact that it can be stored for a long time without deterioration in quality or microbial spoilage since microbial activity may be reduced to a minimum.

Ash represents the mineral matter left after feeds are burnt in oxygen [5]. It is used as a measure of the mineral content in any sample [6]. African nutmeg was found to have highest ash content (1.39%) compared to that of ginger and garlic (Table 1). This means that African nutmeg have good mineral content, and thus serves as a viable tool for nutritional evaluation. However, the value for the ash content in African nutmeg is lower than the 4.52% reported by Enwereuzoh., *et al.* [3]. Okwu [7] had earlier posited that such differences may arise from variations in soil micronutrients and it could also be partly attributed to the method of analyses.

From Table 1, the crude protein content of the African nutmeg (13.57%) was fairly high compared to other spices. This was however higher than the 8.92% earlier reported by Okonkwo and Ogu [8]. It is generally known that any plant food that provides more than 12% of their caloric value from protein is considered to be a good source of protein.

Crude fat (lipid) content of African nutmeg was significantly highest than those of ginger and garlic (Table 1). From this study, it was observed that the lipid content of *Monodora myristica* (46.48%) was significantly ($p < 0.05$) higher than that of garlic (6.13%) and ginger (11.71%), it was also higher than the reported 13.66% earlier documented by Okonkwo and Ogu [8]. The high lipid content is indicative of the fact that African nutmeg is a good source of flavour since it is rich in essential oil and this also suggests possible sources of oil - soluble vitamins.

The percentage of crude fibre was noticed to be higher in African nutmeg (27.39%) which contradicted the reported 10.47% by Okonkwo and Ogu [8] and 8.38% reported by Enwereuzoh., *et al*. [3]. Fibre has some physiological effects in the gastrointestinal tract [9] and low fibre in diet is undesirable as it may cause constipation. However, the low fibre reported in this work for ginger and garlic may not affect the use of the plant, as they are not consumed directly (as main meal) but are used as flavouring agent. The crude fibre content of African nutmeg (27.39%) is relatively high in quantity as revealed from this analysis. This implies that when it is incorporated into food, it will help to prevent many metabolic or digestive disorders such as constipation and irritable bowels [10].

Carbohydrate provides energy to the cells in the body [9]. It is necessary for maintenance of the plasma glucose level and it spares the body protein from being easily digested and helps to prevent the use up of protein. In this study, garlic was found to possess significantly ($p < 0.05$) higher carbohydrate level (18.53%) compared to ginger (2.01%) and African nutmeg (3.06%). Although Otunola., *et al*. [11] documented a carbohydrate content of 73.22% for garlic in their study, Okolo*., et al.* [1] found that garlic possessed a carbohydrate level of 19.43% which was slightly higher than that of this study. However, the high carbohydrate content observed in garlic suggests its high caloric value and is indicative of its high sugar concentration compared to other spices.

As shown in Table 2, the mineral content of the traditional spices revealed that African nutmeg possessed significantly ($p<0.05$) higher sodium (110.20mg/100g), zinc (135.91mg/100g), and iron (147.28mg/100g) while garlic had the highest calcium concentration of 1016mg/100g. Okonkwo and Ogu [8] found sodium and iron concentration of African nutmeg to be 268.82mg/100g and 3.45mg/100g respectively while Otunola., *et al.* [11] found the zinc level of garlic to be 0.34mg/100g which contradicted those of this study. The mineral elements found in these traditional spices are very important in human nutrition. Sodium and calcium play a central role in the normal regulation of blood pressure [12]. In particular, these elements have important interrelationships in the control of arterial resistance [13]. They also regulate the fluid balance of the body and hence, influence the cardiac output. Calcium was the most abundant element found in all spices evaluated and calcium has been reported to be essential for bone and teeth formation [14]. Zinc is distributed widely in plant and animal tissues and occurs in all living cells. Zn dependent enzymes are involved in macronutrient metabolism and cell replication (Arinola, 2008). Zinc is well known trace elements in diabetes as cofactors for insulin [15]. In humans, deficiency diseases or symptoms include hypogonadism, growth failure, impaired wound healing, and decreased taste and smell acuity [16]. Thus, the availability of zinc in African nutmeg seed will aid in the prevention of its deficiency-associated diseases.

Based on the results obtained, all traditional spices recorded varying proportions of the proximate components as well as mineral contents. However, African nutmeg possessed better moisture, ash, crude protein, crude fat, and crude fibre contents with higher sodium, zinc, and iron mineral contents compared to other spices examined while garlic had a better carbohydrate and calcium levels [17-28].

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