NUTRIENTS COMPOSITION AND PHYTOCHEMICAL PROPERTIES OF SELECTED SPICES COMMONLY CONSUMED IN NIGERIA

ABSTRACT

Background: Spices which are widely used in Nigeria have aroma, enhance taste of food and Possess medicinal values.

Objectives: This study aimed to determine the nutrients and phytochemical composition of selected spices commonly consumed in Nigeria

Materials and Method: Raw materials and other ingredients used for this study were purchased from ojaoba in Owo Local Government, Ondo State. The spices were analysed for proximate and mineral components using standard method as described by AOAC (2012). Sodium and potassium was determined using flame photometer and Calcium, selenium, copper, zinc, magnesium and iron was determined using atomic absorption spectrophotometer.

Result: The proximate composition showed that protein was significantly ($p \leq 0.05$) high at 14.41% in Uziza seedand low at 11.60% in tumeric. Ginger contained high moisture content at 10.63%, while Uziza seed had the least value of 8.58%. High ash content was recorded in gingerat 5.27% and lowest 3.70% in Uziza. For carbohydrate, Tumerichad the highest value of 65.57%, while Uzizahad the least value of 60.06%. Mineral compositionshowed high value of calcium in Uziza seed 402.03mg/100g. Nutmeg showed high value of magnesium 13.3mg/100g and turmeric indicated the highest value of potassium 405.43mg/100g, sodium 135.17mg/100g for Uziza seed. Highest content of Iron was recorded in 3.34mg/100g. Turmeric had high value of zinc at 3.77 mg/100g and copper at 97 mg/100g respectively. The spices contained appreciable amount of phytochemicals. However turmeric was significantly higher in alkaloids, flavonoid and polyphenol.

Conclusion: This study showed that spices have greater use in medicine and as food supplement

Keywords: Spices, proximate, mineral composition

INTRODUCTION

Spices are edible portions of plant such as, seeds, fruits, root, bark or vegetables substances that are used as culinary additives all over the world to season, flavor, and preserve dishes. Many spices are also regarded as therapeutic herbs in traditional medicine. Some are frequently used as a preservative to protect food from hazardous microorganisms or to prevent their growth (1,2). Human since the beginning of life adopted the use of spices in a variety of ways throughout cultures and regions, including medicinal, religious ceremonies, cosmetics, and food (3,4) They have been found to play a vital role in health as food, partially as nutrient sources. Even while many spices, especially those produced from seeds, have significant fat, protein, and carbohydrate content by weight, they tend to add few calories to food Spices, on the other hand, can provide a significant amount of minerals and other

micronutrients, such as iron, magnesium, calcium, and many more, to the diet when utilized in bigger quantities (5).Ginger (Zingiberofficinale) is a member of the Zingiberaceae family, and it is known as ginger and locally called Citta among the Hausa people of Northern Nigeria. Ginger is a perennial creeping plant that is widely used as a cooking spice, a common additive for food and beverages due to its flavour and pungency (6). It has a long history of cultivation and is said to have originated in China before spreading to India, South Asia, and Africa. In Nigeria it is commonly cultivated within the middle belt states and is powder fastly becoming a household kitchen item in the country (7). Since prehistoric times, it has been used as a traditional medicine in many nations to cure a variety of ailments including stomach trouble, nausea, diarrhea, arthritis, and painful menstrual periods (8,9).

Nutmeg is the seed or ground spice of various species of the genus Myristicafragrans. Myristicafragrans (fragrant nutmeg or real nutmeg) is a dark-leaved evergreen tree farmed for two spices produced from its fruit: nutmeg and mace. Nutmeg is a spice prepared from the powdered seeds of the aromatic nutmeg tree (Myristicafragrans). The spice is used to flavour baked goods, confections, puddings, potatoes, meats, sausages, sauces, vegetables, and it has a characteristic pungent scent and a warm somewhat sweet taste (10). Uziza (Piperguineense) is locally known as Uziza among the Igbo, Iyere among the Yoruba, Etinkene among the Efik and Ibibio tribes, and Ebe-ahinhiakpoke among the Edo (11,2). Piper guineense leaves and seeds were first used in the southern portion of Nigeria, but consumption has since expanded throughout the country, including neighboring countries such as Benin Republic, Ghana, Liberia, and Cameroun.Piperguineense leaves are commonly used as leafy vegetables in most Nigeria soups while the fruits are used as flavour in most dishes (12). Alkaloids can be found in Uziza, or Nigerian black pepper leaves. Alkaloids are recognized to have a therapeutically effective painkilling action. Therefore, using uziza leaves to treat pains including headaches, toothaches, and sore joints is a great idea. It can also be used to relieve menstruation pain. The leaves demonstrate a good pain-relieving effect. Furthermore, this natural component is completely harmless (13). Turmeric is a vivid orange-yellow spice that is widely used in curries and sauces. Turmeric is derived from the root of the turmeric plant. For thousands of years, the spice has been utilized for its medicinal, antioxidant, and anti-inflammatory effects (14). Turmeric's therapeutic characteristics may be able to help persons with immunological problems by boosting their immune systems (15).It's a powerful anti-inflammatory and antioxidant that may also aid with depression and arthritis problems (16).

MATERIALS AND METHOD

SOURCE OF MATERIALS

Ginger, turmeric, nutmeg and uziza seed were purchased at Oja-Oba in Owo Local Government, Ondo State. All samples were obtained in fresh state, viable free from disease.

SAMPLE PREPARATION FOR ANALYSIS

Preparation of Ginger, Turmeric, Garlic and Nutmeg: All samples were obtained in fresh state, viable free from disease. It was selected and sorted i.e removing the bad ones. The samples were washed, peeled and also re-washed. Slicing, drying, pounding (mortar and pestle) and sieving were all done for the samples. Proper packaging was done for analysis

Ginger	Tumeric	Uziza	Nutmeg
↓	↓	↓	↓
Cleaning/sorting	Cleaning/sorting	Cleaning/sorting	Cleaning/sorting
↓	↓	↓	↓
Peeling	Peeling	Peeling	Peeling
↓	↓	↓	↓
Chipping/slicing	Chipping/slicing	Chipping/slicing	Chipping/slicing
↓	↓	↓	↓
Drying (at 60^0c for	Drying (at 60^0c for	Drying (at 60^0c for	Drying (at 60^0c for
↓	↓	↓	↓
12 hours)	12 hours)	12 hours)	12 hours)
↓	↓	↓	↓
Milling	Milling	Milling	Milling
↓	↓	↓	↓
Ginger powder	Turmeric powder	Uzizapowder	Nutmeg powder

Proximate Analysis

The ash, protein, crude fibre, fat and moisture contents of the prepared spices were determined using the standard methods described by AOAC (17). Total carbohydrate was calculated as the difference between 100 and the sum of the percentages of ash, protein, crude fibre, fat and moisture.

Mineral Analysis and Vitamin Analysis

The mineral contents were determined in a dilute solution of the ashed samples according to the method outlined in AOAC (17) using Atomic Absorption Spectrophotometer (AAS) (210 VGP) for Calcium, Selenium, Copper, Magnesium, Iron, and Zinc while Potassium and Sodium was determined using flame photometer. Water soluble vitamins such as thiamine,

riboflavin, niacin, pantothenic acid, pyridoxine and folic acid were determined using the AOAC method of analysis (17).

Phytochemical Analysis

Determination of Flavonoid

The total flavonoids content was estimated using the procedure described by Zhichen*et al*. (18), a total of 1 ml of sample were diluted with 200µl of distilled water separately followed by the addition of 150 µl of sodium nitrate (5%) solution. This mixture was incubated for 5 minutes and 15 µl of ammonium chloride (10%) solution was added and allowed to stand for 6 minutes. Then 2ml of Sodium hydroxide (4%) solution was added and made up to 5ml with distilled water. The mixture was shaken well and left for 15minutes at room temperature. The absorbance was measured at 510nm.The appearance of pink colour showed the presence of flavonoids content. The total flavonoids content was expressed as rutin equivalent mg RE/100g extract on dry weight basis using standard curve.

Determination of Total Phenol

The amount of total phenolic extracts was determined according to Xu and Chang (19) with slight modifications. After adding Folin-Ciocalteu reagents and sodium carbonate to aliquots of samples, the mixtures were set in 400C water bath for 20 minutes. The absorbance was measured at 740nm using spectrophotometer and the total phenolic content was expressed as milligrams of gallicacid equivalents (GAE) per gram of defatted sample**.**

Determination of alkaloid content

The alkaloid content was determined using the gravimetric method of Harborne (20). The ground spice samples (5.0 g) were each dispersed in 50 ml of distilled water, 95 % methanol, acetone / hexane, n-hexane / methanol / acetone and acetone / water / acetic acid solvents in 250 ml volumetric flasks. These were shaken vigorously and allowed to rest for 4 h before being filtered through What man no. 5 filter paper.

The filtrates were then evaporated to one quarter (1/4) of original volumes, after which concentrated ammonium hydroxide (NH4OH) was added drop-wise to each alkaloid until precipitate persisted. The mixtures were then filtered through weighed filter paper, and the alkaloids residues washed with 1 % ammonium hydroxide solution. The filter papers and contents (alkaloids) were oven-dried at 60 OC for 30 min. and reweighed to determine alkaloids contents using the expression,

$$\text{Percentage (\%) alkaloid} = \frac{W_2 - W_1}{W} X\ 100$$

Where, W = weight of spice sample, W_1 = weight of empty filter paper,

W_2 = weight of filter paper plus alkaloid precipitated.

Determination of phytate content

Phytate content was determined according to the method of AOAC (17). The spice sample (4.0 g) was soaked in 100 ml of distilled water, 95 % methanol, acetone/water/acetic acid, acetone/hexane or hexane/methanol/acetone solvent for 3 h and then filtered through Whatman N0. 2 filter paper. The filtrates (25 ml) were pipetted into 50 ml conical flasks, and 5ml of 0.3% ammonium thiocyanate solution added, after which 53.5 ml of distilled water was added and the mixtures were titrated against standard Iron (iii) Chloride solution containing 0.00195g Fe3+ / ml until a brownish yellow colour persists for 5min. The phytate content of the spices was expressed as percentage (%) phytate in the spice sample.

Saponin content determination

Ground sample (1 g) of each spice was macerated in 10ml of distilled water, 95 % methanol, acetone/water/acetic acid, acetone/hexane or hexane/methanol/acetone; and the extract decanted into a 50 ml beaker. The residue was re-extracted with another 10 ml of solvent, allowed to rest and then decanted into the formal beaker. The extract was pooled together and evaporated to dryness, re-dissolved in 6ml of ethanol and 2 ml of the ethanol extract allowed to stand for 30 min for colour development. Absorbance was read at 550 nm and used to extrapolate saponin content from a standard curve.

STATISTICAL ANALYSIS

The result was expressed as mean ± standard deviation and the test for statistical significance was carried out using one-way analysis of variance (ANOVA). Significant means was separated using Duncan's New Multiple Range Test (DNMRT) and differences was considered significant at $p \leq 0.05$

RESULTS AND DISCUSSION

Table 1 Proximate composition of four traditional spices.

Samples	Moisture	Ash	Fat	Fibre	Protein	Carbohydrate
A	10.48 ± 0.04^{b}	4.17 ± 0.01^{c}	3.82 ± 0.02^{d}	4.37 ± 0.05^{c}	11.60 ± 0.2^{d}	65.57 ± 0.09^{a}
B	10.63 ± 0.03^{a}	5.27 ± 0.04^{a}	4.51 ± 0.01^{c}	3.93 ± 0.03^{d}	13.13 ± 0.26^{b}	62.54 ± 0.10^{b}
C	10.48 ± 0.03^{c}	4.20 ± 0.01^{b}	5.82 ± 0.00^{b}	5.24 ± 0.02^{b}	12.76 ± 0.01^{c}	61.50 ± 0.05^{c}
D	8.58 ± 0.02^{d}	3.70 ± 0.01^{d}	6.09 ± 0.01^{a}	7.17 ± 0.05^{a}	14.41 ± 0.02^{a}	60.06 ± 0.08^{d}

Mean values with standard deviation. Values with the same superscript in the same columns are not significantly at ($P \leq 0.05$).
Key:A = Turmeric**, B** = Ginger**, C** = Nutmeg**, D** = Uziza seed

Proximate composition of four traditional spices

Table 1 shows the proximate composition of four traditional spices analysed; ginger, turmeric, nutmeg and uzizaseed.. Sample B (Ginger) had the highest value of moisture (10.63%) while sample D (Uziza seed) had the lowest value of 8.58%, however there was no

significance difference ($p \leq 0.05$) between sample A (Turmeric) and sample C (Nutmeg). Sample B had the highest Ash content while sample D had the lowest Ash content. In terms of fat content, sample D (6.09%) was significantly ($p \leq 0.05$) higher than sample A (3.82%), B (4.51%) and sample C (5.82%). For the fibre content, sample D had the highest value of 7.17%% while sample B had the lowest value of 3.93%, Sample D had the highest value of protein (14.41%). The table also showed the carbohydrate contents of the samples; Sample A (65.57%) was significantly ($p \leq 0.05$) higher than sample B, C and D.

Table 2 Mineral composition of four traditional spices

Samples	Na	Ca	K	Zn	Cu
A	28.47 ± 0.058^{d}	181.67 ± 0.153^{c}	405.43 ± 0.321^{a}	3.77 ± 0.003^{a}	0.18 ± 0.002^{b}
B	35.57 ± 0.115^{c}	$72.57. \pm 0.058^{d}$	374.47 ± 0.153^{b}	1.36 ± 0.031^{d}	0.30 ± 0.003^{a}
C	112.47 ± 0.058^{b}	327.77 ± 0.306^{b}	140.60 ± 0.100^{d}	3.19 ± 0.008^{b}	0.10 ± 0.006^{d}
D	135.17 ± 0.153^{a}	402.43 ± 0.0115^{a}	174.97 ± 0.208^{c}	2.78 ± 0.021^{c}	0.12 ± 0.002^{c}

Mean values with standard deviation. Values with the same superscript in the same columns are not significantly at ($P \leq 0.05$).
Key: A = Turmeric**, B** = Ginger**, C** = Nutmeg**, D** = Uziza seed

Table 3 Mineral composition of four traditional spices.

Samples	Mg	Se	Fe
A	12.72 ± 0.026^{b}	0.02 ± 0.003^{d}	3.34 ± 0.071^{a}
B	10.70 ± 0.107^{d}	0.03 ± 0.002^{c}	2.28 ± 0.068^{b}
C	13.13 ± 0.029^{a}	0.22 ± 0.006^{b}	1.24 ± 0.005^{c}
D	10.82 ± 0.005^{c}	0.28 ± 0.005^{a}	0.79 ± 0.05^{d}

Mean values with standard deviation. Values with the same superscript in the same columns are not significantly at ($P \leq 0.05$).
Key: A = Turmeric**, B** = Ginger**, C** = Nutmeg**, D** = Uziza seed

Mineral composition of four traditional spices

Presented in table 2 & 3 are the result obtained for the mineral composition of four traditional spices (turmeric, ginger, nutmeg and uziza seed). The result shows that calcium and potassium were the predominant mineral element ranging between 72.57-181.67 and 174.97-405.43 for calcium and potassium respectively.Sample D (uziza seed) had the highest sodium content while sample A (turmeric) had the lowest sodium content.. The copper content of sample A (0.18ppm), B

(0.30ppm), C (0.10ppm) and sample D (0.12ppm) were significantly different $p \leq 0.05$. Sample B (ginger) had the highest copper content while sample C (nutmeg) had the lowest copper content. For the magnesium content, sample C (nutmeg) had the highest value of 13.13ppm while sample B had the lowest value of 10.70ppm,

Table 4: Vitamin Composition of commonly consumed spices

VITAMINS (mg/100g)	SAMPLE A	SAMPLE B	SAMPLE C	SAMPLE D
B1 (thiamine)	$0.27^{c} \pm 0.0$	$0.30^{b} \pm 0.0$	$0.60^{a} \pm 0.0$	$0.21^{d} \pm 0.0$
B2 (riboflavin)	$0.29^{d} \pm 0.0$	$0.31^{c} \pm 0.0$	$0.89^{a} \pm 0.0$	$0.51^{b} \pm 0.0$
B3 (niacin)	$8.05^{b} \pm 0.0$	$8.48^{a} \pm 0.0$	$4.34^{c} \pm 0.0$	$2.90^{d} \pm 0.0$
B5(Pantothenic acid)	$0.97^{b} \pm 0.0$	$1.26^{a} \pm 0.0$	$0.56^{c} \pm 0.0$	$0.48^{d} \pm 0.0$
B6 (pyridoxine)	$50.01^{b} \pm 0.3$	$62.13^{a} \pm 0.1$	$32.46^{c} \pm 0.2$	$28.90^{d} \pm 0.4$
B9 (folic acid)	$106.76^{a} \pm 0.2$	$94.50^{b} \pm 0.2$	$74.66^{d} \pm 0.2$	$80.10^{c} \pm 0.1$

Values of mean ± standard deviation triplicate sample $^{a-d}$ Mean with similar super script in each row are not significantly different (P>0.05)
KEY: Sample A- Tumeric, Sample B- Ginger, Sample C- nut Meg, Sample D- uziza seed

Table 4: shows the vitamin composition of vitamin composition of four traditional spices commonly consumed in Nigeria.The vitamin B_1 and vitamin B_2 content was generally low in the samples. The result further shows that the samples were generally high in vitamin B_6 (Pyridoxine) and B_9 content. Sample A was significantly higher in B_9 followed by sample B 94.50 and D 80.10 respectively.

Table 5: **phytochemical properties of spices commonly consumed in Nigeria.**

Sample	Alkaloid	Polyphenol	Saponin	Flavonoid	Phytate
A(aq)	52.15 ± 0.00^{c}	18.29 ± 0.01^{d}	0.34 ± 0.00^{a}	6.86 ± 1.72^{a}	1.37 ± 0.02^{a}
A(m)	60.32 ± 0.04^{a}	25.08 ± 0.02^{a}	0.28 ± 0.00^{b}	6.15 ± 0.03^{b}	0.74 ± 0.05^{e}
B(aq)	40.70 ± 0.10^{g}	10.48 ± 0.02^{h}	0.22 ± 0.00^{d}	4.64 ± 0.02^{c}	0.65 ± 0.01^{f}
B(m)	48.19 ± 0.01^{e}	20.36 ± 0.11^{c}	0.20 ± 0.00^{e}	4.88 ± 0.02^{c}	0.58 ± 0.01^{g}
C(aq)	34.96 ± 2.32^{h}	14.73 ± 0.00^{g}	0.19 ± 0.00^{f}	3.29 ± 0.01^{d}	0.87 ± 0.00^{d}
C(m)	43.16 ± 0.01^{f}	15.61 ± 0.00^{f}	0.24 ± 0.00^{c}	3.84 ± 0.01^{d}	0.91 ± 0.00^{c}
D(aq)	50.25 ± 0.03^{d}	17.36 ± 0.01^{e}	0.14 ± 0.00^{h}	4.24 ± 0.01^{cd}	0.97 ± 0.00^{b}
D(m)	57.58 ± 0.00^{b}	24.11 ± 0.01^{b}	0.18 ± 0.00^{g}	4.51 ± 0.00^{c}	0.94 ± 0.00^{bc}

Values of Mean ± Standard deviation of triplicate sample a-hMean with similar super script in each column are not significantly different (P>0.05)
Key: Sample A(aq) – aqueousTumeric ,Sample A(m) – water Tumeric, Sample B(aq) – aqueous Ginger, Sample B(m) – water ginger, Sample C(aq) – aqueous Nut Meg
Sample C(m) – water Nut Meg, Sample D(aq) – aqueous Uziza seed, Sample D(m)- water Uziza seed

Table 5: shows the phytochemical properties of spices commonly consumed in Nigeria. Sample A (turmeric) is significantly (P>0.05) higher in Alkaloids,Polyphenol, Flavonoid.While the values recorded Saponin were generally low. It ranged from 0.34 in

sample A (aq) to 0.14 in sample D (aq) and 0.28 in sample A (m) to 0.18 in sample D (m) The table also revealed that sample A (qq) has the highest (0.355mg/100g) Saponin content while sample D (qq) has the least (0.120mg/100g) Saponin content

DISCUSSION

spices are generally used for flavour, preservatives and therapeutic purposes. Hence this study analysed the nutrients and phytochemical properties of some selected spices commonly used in Nigeria. The moisture contents of the samples ranged from 8.58% - 10.63%. These values were in similar agreement (9.12% - 11.55%) with Ojinnaka*etal*.,(21)on Comparative Study on the Nutrient and Antinutrient Composition of the Seeds and Leaves of *Uziza (Piper Guineense).* The moisture content of any food has been noted to be one of the major indicators that influence the shelf stability of foods. Food samples with low moisture contents indicates low water activity which means moisture will not be available for microorganisms which are the principal agents of spoilage (22) The crude fat ranged between 3.82% and 6.09%. According to this study, uziza seed had the highest value (6.09%) while turmeric had the least value (3.82%) of fat content. The decreased in fat content of sample turmeric could be due to insufficient lipid concentration in fruits. Nwofia*et al.,* (23) have earlier reported that low lipid concentration in fruits indicates that the lipids are mobilized and stored in the seeds thereby making it a good source for people suffering from obesity. These values were comparable to values reported for traditional spice (15,24). Dietary fat has been shown to be very important in the absorption of and retention of flavour thus enhancing palatability (24,25). The ash content ranged between 3.70% and 5.27%. Ginger had the highest ash content, the ash values obtained for Turmeric (curcumin) and Nutmeg (Myristicafragnans) were similar to 4.33% reported by Nita and Aradhita (4) on black cumin seed used as spice. The ash content indicate the amount of mineral composition present in food and high ash content is an indication of high inorganic mineral content (26).

The fibre content in this study (3.93-7.17) were similar to the range 5.36 -6.42 reported by Udenevwo (27). The crude fiber of the sample D (uziza seed) was evidently higher (7.17%) than that of the other samples. This value compare well with 7.33 reported by Nita and Aradhita (4). Agostoni*et al*. (28) reported that non-starchy crops are the richest sources of dietary fiber. Crude fiber is the part of food that remain undigested by human large intestine but the normal functioning of the intestinal tract depends upon the presence of adequate fiber. It is helpful in the management of non-communicable diseases like obesity, cancer, hypertension, and other NCDs because it increases stool bulk and shortens the time waste materials spend in the digestive tract (29).

The protein content of the samples ranged from 11.60%-14.41% were similar with 8.91% – 13.57% reported by Onimawo et al., (30). Protein has been proved to be an essential component for both human and animal survival, as well as being required for the synthesis of the structural elements of the human body, such as the muscles and organs(31).

The finding shows that carbohydrate contents ranges from 61.50%-65.57% with significant difference ($p \leq 0.05$). This is higher compared to the findings of Ameh*etal.*,(32) who reported 6.31% to 33.79% on Survey for the composition of some common spices cultivated in Nigeria. Carbohydrates are the most abundant biological molecules and play important roles as sources of energy to the body, brain, heart, nervous, digestive function and immune system(22). The results of this study indicate that the spices possess moderate amounts of carbohydrate and these can provide accessible fuel (energy) for physical performance and regulate nerve tissues.

The sodium content of the samples ranged from 28.47ppm - 135.17ppm. The report of this finding showed that regular consumption of ginger (35.57ppm) especially turmeric (28.47) which is low in sodium could help to prevent hypertension. This result agrees with the findings of Dahl, (33) who reported that low sodium content of these spices could be an advantage because of the direct relationship between sodium intake and the hypertension in human beings.

In this study, it was found that calcium (402.43ppm) content of Uziza seed was significantly ($p \leq 0.05$) higher than the rest of the samples. A balance proportion of calcium is needed in the body. Calcium is an essential mineral component in the body which helps in regulating muscular contractions, strong teeth formation also development of strong bones and is needed for the prevention of osteoporosis, arthritis, rickets and tooth decay (31).

The selenium content of the samples ranged from 0.02-0.28ppm. Sample D (uziza seed) had the highest value (0.28ppm) while sample A (turmeric) had the least value (0.02ppm). These values are low compare to 5.8 - 23.0 reported by Sirichakwal*et al.*, (34) on selenium content of Thai Foods and 0.254-0.505 reported by (35). Selenium is an important trace element that helps in the synthesis of various Selenium- containgprotiens and also has other relevant biological usefulness as well as playing important role in the human diet due to it ability to act as a preventive agentsagains some health challenges (36, 37). The low level of Se in foods has been ascribed to the low soil content in selenium, such as in volcanic regions (38).

The Iron content of the four spices ranged from 0.79ppm-3.34ppm. These values were higher than the values recorded by Ameh et al., (32). Iron content in Turmeric (3.34ppm) was

significantly ($p \leq 0.05$) higher compared to Nutmeg (1.24ppm). Iron is an essential trace element that forms an integral part of many proteins and enzymes which plays an important role in the human body in maintaining good health, control of infection and cell immunity. (39).

Potassium content was relatively high in all cases except in two samples (Nutmeg, 140.60ppm and Uziza seed, 174.97ppm). The highest value was observed for Turmeric with an average value of 405ppm.This is the most abundant of the entire element determined in these samples. Potassium functions in the body to regulate processes such as nerve transmission, muscle contraction and control fluid balance and enhances the metabolism of protein and carbohydrate (40,41).

The zinc contents of the four samples ranged from 1.36ppm-3.77ppm. These were significantly higher when compared with the Recommended Dietary Allowance (RDA) (42).however the values observed in this study were significantly lower than the values reported by Ameh et al., (32) in there study for spices. Findings from this study indicate that turmeric has the highest value of zinc. Zinc is very essential for growth, protein synthesis, immunity and sexual functions. Consumption of food items that are rich in Zinc will help in combating malnutrition and parasitic illnesses like malaria (43).

Minerals are an important part of a healthy diet. Nutrition professionals recommend that they be consumed as part of a balanced diet, primarily as fruits and vegetables (44). The result of the mineral composition of this study has collaborated with the several other work that reported the presence of mineral elements such as calcium, iron, potassium, phosphorus, sodium, magnesium, copper and zinc in spices which are very important to human nutrition (45, 4,27).

The vitamin B1 and B2 content of these spices was generally lower than those reported by (46,47). Thiamine plays an active role in the oxidative decarboxylation of pyruvic acid thus reducing the accumulation of pyruvic acid and its reduction product latic acid in the tissue which in turns reduce the occurrence of muscular weakness(47). Sample B (ginger) is highly rich in B-complex vitamins more than turmeric, nutmeg and uziza seed, its inclusion in diet could be good source of anti-oxidants and enough vitamins for formation of enzymes that are essential for optimum health (48). Vitamin B5 varies from ($0.48^{d} \pm 0.0$) in sample D to ($1.26^{a} \pm 0.0$) in sample B with sample B showing the highest Value in quality of vitamin B5with their significant difference $p>0.05$. Pantothenic acid is important for the production of energy, hormone synthesis and the metabolism of fat, protein and carbohydrates (49). The spices were generally high in vitamin B_9. Inclusion of this spices in diet helps in promotion of

red blood cell formation and maturation, it is also lowers neural tube birth defects, and helps to control homocysteine levels, thus potentially reducing the risk of coronary heart disease (49).

Phytochemicals exhibit great antioxidant potential and produces beneficial effect to the human health (50). The spices in this study contains quite an appreciable quantity of different phytochemicals in varying amounted, each of these phytochemicals are famous for various protective and advantageous properties. Turmeric (sample A) was significantly higher in alkaloids, polyphenols and flavonoids compared to others. Flavonoids and alkaloids as well as their synthetic derivatives are used as medicinal agents as analgesic, antimalarial, antiseptic, antioxidant antitumor anticancer and bactericidal (51,52). In generalthe presence of these phytochemicals in spices this studycould be responsible for their much acclaimed medicinal uses in various disease conditions such as atherosclerosis, arthritis, nausea, asthma, worm expeller, bacterial infections and cancer.

CONCLUSION

This study showed that the spices contained high content of crude protein with low fat content and crude fibre. The low moisture content indicates good quality and its prolonged shelf life especially in Uziza seed. The spices are good sources of carbohydrate, thus contributes to the energy generation for cellular activities. The ash contents suggest that they are good sources of minerals. The spices contained appreciable amount of valuable nutrients however Uziza contained more fat, fibre and protein than the rest of the spices.

The spices also contained quite an appreciable amount of various minerals and phytochemicals. The result suggest that the spices if use judiciously in sufficient amount would contribute greatly towards meeting human nutritional requirement for normal growth and adequate protection against diseases.

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