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Potentials of Selected Spices in South-East Nigeria: Proximate, Phytochemical, and Minerals Perspectives

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ABSTRACT

This study examined the phytochemicals, proximate, and metal compositions of ten (10) different local spices obtained from Relief market in Owerri, Imo State. The local spices investigated were five (5) leaves namely celery, mint, coriander, bay, country onions and five (5) seeds namely cinnamon, parsley, orima, fennel, and fenugreek. Proximate analysis was achieved using standard methods. Mineral composition analysis was done using Flame Photometer and Atomic Absorption Spectrophotometer. Phytochemical screening of the samples was carried following standard methods. The result of the phytochemical test showed that the local spices contained all the bioactive molecules except for the absence of terpenoids, tannins, saponins, and hydrogen cyanide in some of spices. Proximate analysis result revealed that the ash content of the samples ranged between 1.71-25.17%, moisture content (2.14-18.34%), fiber (2.14-29.19%), lipid (0.94-7.32), protein (4.75-24.59%), carbohydrate (26.78-76.72%), and energy (707.38-1494.13 kJ/100g). The mineral composition showed that the local spices contained low levels of copper (0.15-0.28 mg/kg), zinc (0.36-0.89 mg/kg), and manganese (1.25-12.35 mg/kg) and high levels of calcium (1366.25-4040.25 mg/kg), magnesium (583.13-3446.28 mg/kg), potassium (666.25-1947.50 mg/kg), sodium (362.30-405.00 mg/kg), phosphorus (55.00-218.75 mg/kg), and iron (48.80-109.35 mg/kg). The mineral composition showed no significant differences ($p < 0.05$) in magnesium, potassium, iron, sodium, and calcium contents. This work recommends the application of the spices as supplementary sources of essential nutrients to man, livestock, and antimicrobial agent.

1. INTRODUCTION

Plants are holders of resources that contribute to the basic needs of both human being and animals such as food, clothing, and shelter [1, 2, 3]. Medicinal plants are among plants of economic importance and have been utilized as therapeutic agents in the previous years [4, 5, 6, 7]. The healing properties of many herbal medicines have been recognized in many ancient cultures and have been the backbone of traditional herbal medicine amongst rural inhabitants worldwide since medieval ages to date [8, 9]. Natural products have

been an integral part of the ancient traditional medicine systems [10, 11]. Over the years natural products have been the core in the development of traditional and modern drugs [12, 13].

About 3.4 billion people in the third-world countries depend on plant-based traditional medicines with about 88% of the world's inhabitants relying mainly on traditional medicine for their primary health care [1, 14].

The global apprehension on the maintenance of health status through the application of materials of organic origin has necessitated the consumption of spices. Spices are plant parts specially known for their aromatic, fragrant, pungent, or any other desirable properties including the seed (e.g., Ataiko orima, fenugreek, and coriander), leaf (fennel, celery, parsley, bay, and mint), berry (allspice, juniper, and black pepper), bark (cinnamon), kernel (nutmeg), aril (mace), stem (chives), stalk (lemongrass), rhizome (ginger, turmeric, and galangal), root (lovage and horseradish), flower (saffron), etc [15].

Spices are regarded as precursors of flavor in food, religious rituals, cosmetics or perfumes, and medical applications [16, 17]. Zachariah *et al*. [18] reviewed that the quality of spices is largely dependent on the chemical composition essential oils. 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 [19].

Currently, food experts continually source for new and distinct spice flavorings due to the growing global demand for authentic ethnic and cross-cultural cuisines. Consumers are also sensitive seeking for natural foods and natural preservatives that will guaranty healthier lifestyles and natural ways of preventing several ailments [20]. Some of these spices contain phytochemicals. According to Sofowora [21], phytochemicals are plant metabolites which act as natural defense systems for host plants, and also provide characteristic colour, aroma and flavor in specific plant parts. They are a group of non-nutrient compounds that are biologically active when consumed by human. Many bioactive compounds enhance good health and invariably prevent the occurrence diseases [22, 19, 23]. Shahidi [24] and Rudzińska *et al*. [25] reported that bioactive compounds are available in cereals, fruits, vegetables, etc and are mainly responsible for low incidence of chronic and degenerative diseases

Harsha *et al*. [26] reported that vast existence of plants species has not been fully beneficiated phytochemically and biologically. The medicinal importance of plants lies in some chemical composition that have a definite physiological action on the human body. Different bioactive compounds have been identified to possess a wide range of biological activities, which may be of benefit in protection against chronic diseases [25].

Malnutrition and microbial outbreak are major challenges to human health both in rural and urban centers, most especially in developing country like Nigeria. The paucity of knowledge on the nutrient constituents' catalytic activities of these indigenous spices has resulted in their neglect and underutilization. It is believed that the result of this study will initiate the exploitation of the preservative, nutraceutical and therapeutic potentials of these culinary spices.

Therefore, this study focused on the evaluation of the bioactive compounds of ten spices including five leaves namely Bay, Mint, Celery, Fennel, Parsley, and five (5) seeds namely Country onions, Orima, Fenugreek, Coriander, and Cinnamon for broader application in foods and other relevant areas.

2. MATERIALS AND METHODS

2.1 Sample Collection and Preparation

Fresh ten (10) different plant spices including five leaves namely Bay, Mint, Celery, Fennel, Parsley, and five (5) seeds namely Country onions, Orima, Fenugreek, Coriander, and Cinnamon free from disease were purchased from Relief market in Owerri, Imo state, Nigeria during the month of May, 2023. The plant spices were identified and certified at Herbarium Unit of Plant Science and Biotechnology Department, University of Port Harcourt, Rivers State, Nigeria. The spices were air-dried and impurities were removed. It was milled into powder and the powder kept in an air-tight polythene bags for further use.

2.2 Preparation of the Spices Extracts

Analytical grade chemicals and reagents were used in this study. Solvent extraction of the samples was done by cold extraction; 30 g of powdered sample of each of the spices was soaked in 200 ml of ethanol. The mixture was kept at room temperature for 72 hr in a sterile flask covered with aluminium foil and subjected to filtration through sterilized Whatman No.1 filter paper. The extracts were heated to dryness in rotary pressure evaporator at 40^{o}C and ready for characterization [15].

2.3 Mineral Element Analysis

Mineral element analysis was determined according to the official method of the Association of Official Analytical Chemists [27]. To 1.0 g of each sample was added 20 ml HNO_3 in a 100 ml beaker. The mixture was placed on a hot plate and the temperature maintained at 130^{o}C for four (4) hr until the solution became clear. After cooling, the mixture was filtered through Whatman No.1 filter paper to remove the insoluble particles and made up to a final volume of 50 ml with distilled water. Appropriate dilutions were made for each sample before analysis. Potassium and sodium were determined using Jenway Digital Flame Photometer while other mineral elements namely Mg, Ca, Fe, Cu, Mn, P and Zn were evaluated using Buck Scientific Atomic Absorption Spectrophotometer (BUCK 210VGP model).

2.4 Proximate Analysis

The powdered samples were subjected to proximate analysis for the determination of the major nutritional component of the plant seeds. This method separated nutrients in the spices into six components: Moisture (dry matter), ash, crude protein, crude fat (ether extract), crude fibre and nitrogen-free extract as described by Evuen *et al*. [28]. However, the calorific energy value was obtained according to the methods of Akinyeye *et al*. [29. 30] and Kilgour, [31].

2.5 Phytochemical Screening

Qualitative phytochemical screening of the powdered spices with respect to saponins, tannins, alkaloids, flavonoids, triterpenoids, phenols, steroids, cardiac glycosides, oxalates, phytates, and hydrogen cyanides was carried out by procedures reported by Harborne [32], Sofowora [21], Savithramma *et al*. [33], and Obouayeba *et al*. [34].

2.5.1 Quantitative Analysis

2.5.1.1 Determination of Phenol

The extract was added to 50 ml of hexane and 30 ml of methanol. Then, the mixture was made up and left to stand overnight. Aliquot of the mixture (1 ml) was added to 5 ml Folin – ciocalteus phenol reagent. The mixture was shaken well and allowed to stand for 5 min, then 1 ml of Na_2CO_3 was added and shaken before standing for 1 hr at room temperature. The absorbance was read at 725 nm using UV-Vis Spectrophotometer.

2.5.1.2 Determination of Saponins

The extract was dissolved in 80% methanol and 2 ml of Vanilin in ethanol was added, mixed well and the 2 ml of 72% sulphuric acid solution was added, mixed well and heated on a water bath at 60^{o}C for 10 min. The absorbance was measured at 544 nm against reagent blank. Diosgeninis used as a standard material and compared the assay with Diosgeninis equivalents.

2.5.1.3 Determination of steroids

The gravimetric method described by Harborne [32] was used in the determination of the steroid content of the samples.

2.5.1.4 Determination of Alkaloids

One ml of methanolic extract and 5 ml at pH 4.7 phosphate buffer was added in 5 ml bromocresol green (BCG) solution and the mixture was shaken with 4 ml of chloroform. The extracts were collected in a 10 ml volumetric flask and then diluted to adjust volume with chloroform. The absorbance of the complex in chloroform was measured at 470 nm against blank prepared as above but without extract. Atropine was used as a standard material and compared the assay with Atropine equivalents.

2.5.1.5 Determination of flavonoids

Total flavonoid content was determined by aluminium chloride method using catechin as a standard. 1 ml of test sample and 4 ml of water were added to a volumetric flask (10 ml volume). After 5 min, 0.3 ml of 5 % sodium nitrite, 0.3 ml of 10% aluminium chloride was added and incubated after 6 min at room temperature, 2 ml of 1 M sodium hydroxide was added to the reaction mixture. Immediately the final volume was made up to 10 ml with distilled water. The absorbance of the reaction mixture was measured at 510 nm against a blank spectrophotometrically. Results were expressed as catechin equivalents (mg catechin/g dried extract).

2.5.1.6 Determination of Tannin

The amount of total tannin in the samples was determined using the method described by AOAC [27] with slight modifications. The samples (1 g in triplicate) were dissolved in 80 ml of distilled water and boiled for 30 min. The solution was cooled, transferred into a 100 ml volumetric flask and made up to mark with distilled water. The solution was filtered with Whatman filter paper No 1. Folin Denis reagent and saturated sodium carbonate solution were prepared in accordance with the standard for tannin content analysis. Also, standard solution of tannic acid was freshly prepared and aliquots (0 ml, 0.5 ml, 1 ml, 1.5 ml, 2 ml, 2.5 ml) were dispensed into 25 ml volumetric flasks. 1.25 ml of Folin-Denis reagent and 2.5 ml of sodium carbonate solution were added to each flask. Each mixture was made up to the volume of the flask with distilled water. The colour was measured after 30 min using spectrophotometer at 760 nm. To (5 ml) of the filtrate in the volumetric flask was added 1.25 ml of Folin-Denis reagent and 2.5 ml of sodium carbonate solution. The amount of Tannin content was measured by extrapolation.

2.5.1.7 Determination of Cardiac Glycosides

This was determined according to the procedure of Osagie [35].

2.5.1.8 Determination of Oxalate by Titration Method

This was determined according to Osagie [35].

2.5.1.9 Determination of Phytate

Phytate contents were determined using the method of Young and Greaves [36] as adopted by Lucas and Markakes [37].

2.5.1.10 Determination of Total Terpenoid Content

The total terpenoid content of the extracts was determined based on an assay described by Ghorai *et al*. [38] with some modifications. Linalool was used as the standard for estimation. An aliquot of the reaction mixture obtained after Salkowski test employed for the qualitative analysis of terpenoids in the extract was transferred to colorimetric cuvette. The absorbance was measured at 538 nm against blank i.e., 95% (v/v) methanol. For the standard curve, 200 µl of linalool solution in methanol was added with 1.5 ml chloroform and serial dilutions (dilution level-100 mg/200 µl to 1 mg/200 µ linalool Conc.) were prepared in which total volume of 200 µl was made up by the addition of 95% (v/v) methanol. Calibration curve of linalool was plotted and the total terpenoid content expressed as milligrams of linalool equivalents per gram of dry weight (mg linalool/g DW) was determined using the regression equation. Samples were analyzed in triplicates.

2.5.1.11 Determination of Cyanide Content

Five grams of the sample was dissolved in 50 ml of water in a conical flask, corked and was allowed to stay overnight. The solution was then filtered with media paper for cyanide determination. 1 ml of the filtered solution was transferred into another conical flask and 4 ml of alkaline picrate solution was added and incubated at 50°C in a water bath for 5 min. Colour development and absorbance was taken at 490 nm. A blank preparation using 1 ml distilled water was made. The cyanide content was extrapolated using standard curve and reported as mean of duplicate determination [35].

3. RESULTS AND DISCUSSION

3.1 Proximate Analysis

The proximate composition of the local spices in Figure 1 shows low value of ash content ranging from 1.17 ± 0.00% – 25.17 ± 0.01%. Though the ash content was higher in celery leaves (25.17 ± 0.01%) and lower in country onions leaves (1.17 ± 0.00%). This result showed that the spices under study could be a good source of minerals as revealed in the mineralogical compositions. The ash content values obtained in this study were higher than the other spices determined by various researchers [38, 40].

The moisture content revealed that celery and country onion leaves contained the highest and lowest moisture content (18.34 ± 0.69%) and (2.14 ± 0.01%) respectively among the ten (10) selected local spices. The result though not high but lower than the moisture content of *Allium cepa, Allium sativa,* and *Ocimum gratissium* [15] reveals the level of stability (lees attack from microorganisms) with country onion leaves being more stable than the other spices. However, the differences in the values of the moisture content could be due to climatic changes and different processing methods which are in agreement with other published works [15, 41].

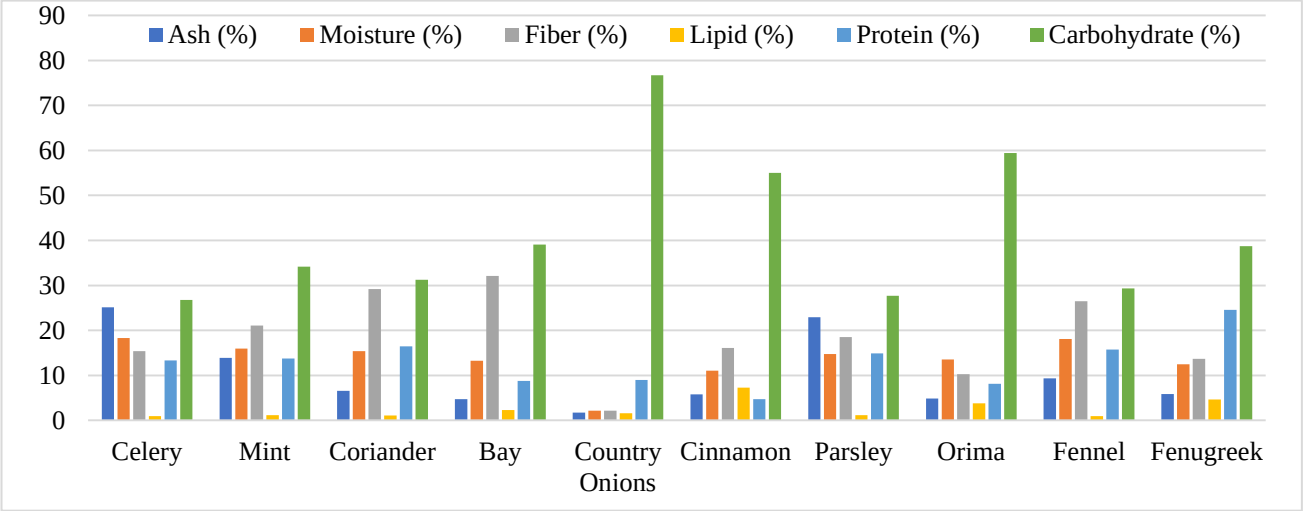

Figure 1. *Proximate composition of selected spices*

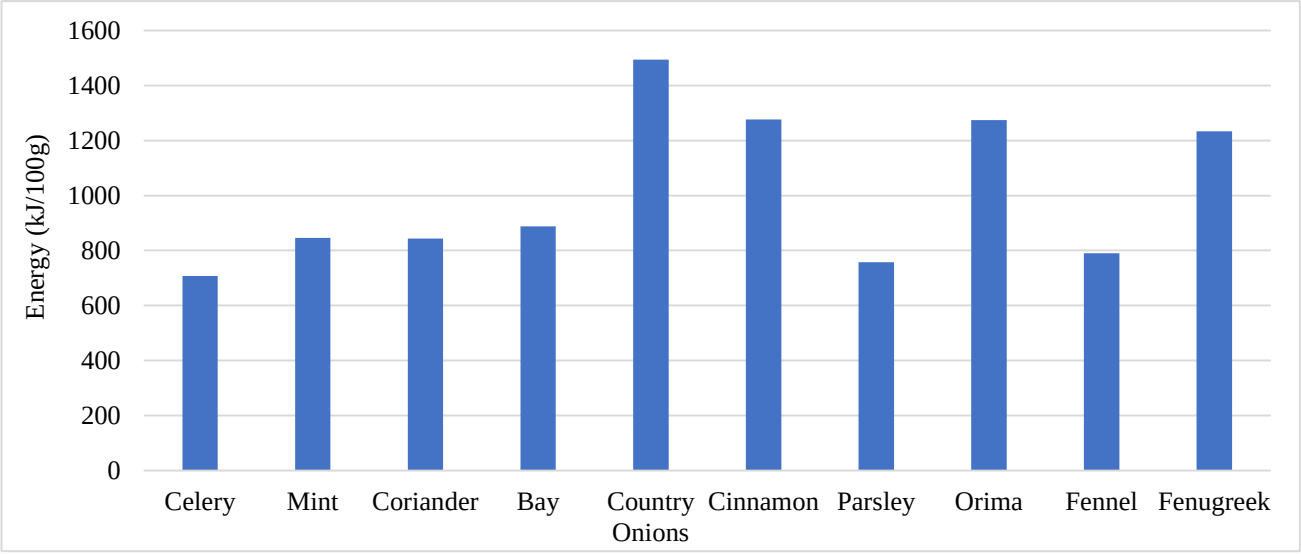

Figure 2. *Energy content of selected spices*

The fiber content showed variations in the values obtained with the highest in bay leaves (32.11 ± 0.01%) and lowest in country onion leaves (2.14 ± 0.01%) respectively. The presence of fiber in the spices under study is beneficial because of its physiological effects on gastrointestinal tracts. This activity is extended to variation in fecal water, fecal bulk, and transit time and elimination of bile acids and neutral steroids which lower the body's cholesterol pool [41]. Of course, bay leaves having the highest value of fiber content will be suitable for this operation. This observation is in agreement with the work of Akinola *et al*. [40] having highest value of 12.79 ± 0.35% obtained for bay leaves.

The lipid content of the selected spices was low with the highest value in cinnamon seeds (7.32 ± 0.15%) and lowest value in fennel seeds (0.94 ± 0.01%). The result revealed that the leaves have lower fat than the seed spices in line with other medicinal plants [40, 28]. The low concentration of lipid in fennel makes it of more advantage to human health because excess consumption of fats in humans can lead to cardiovascular diseases, ageing, and cancer [42, 40].

The protein content was highest in fenugreek

seeds (24.59 ± 0.01%) and lowest in cinnamon seeds (4.75 ± 0.00%). The high protein content in fenugreek suggests that it could be used in the management of protein deficiency cases such as kwashiorkor. It implies that fenugreek seeds can be used in the improvement of the palatability of foods [41]. The protein values obtained in this study were higher than that reported by Akinola *et al*. [40] for bay and celery leaves. The variations in the values of protein obtained in this study could be due to different locations in which the leaves and seeds are collected.

The carbohydrate content showed highest value in country onion leaves (76.72 ± 0.01%) and lowest value in celery leaves (26.78 ± 0.90 %). This result was lower than the values of celery and bay leaves obtained by Akinola *et al*. [40]. Although, the result obtained in this study was moderate and within the range reported by other scientists [43, 15, 28]. However, carbohydrate as a good source of energy maintain the life of plants, animals, and humans. Hence, country onion leaves having the highest carbohydrate content represent a good source of energy.

Table 1a. *Mineral composition in (mg/kg) of some selected leaves in Imo State*

Parameter	Celery	Mint	Coriander	Bay	County onions
Mg	3446.28 ± 0.02^{a}	1428.13 ± 0.50^{a}	1297.50 ± 0.50^{a}	583.13 ± 0.02^{a}	904.38 ± 0.05^{a}
K	1166.25 ± 0.00^{a}	989.38 ± 0.20^{a}	1166.88 ± 0.30^{a}	906.25 ± 0.30^{a}	666.25 ± 0.00^{a}
Na	393.75 ± 0.00^{a}	405.00 ± 0.00^{a}	372.50 ± 0.20^{a}	370.00 ± 0.00^{a}	373.00 ± 0.01^{a}
Ca	4,040.25 ± 0.30^{a}	2610 ± 0.30^{a}	1787.50 ± 0.01^{a}	3258.75 ± 0.02^{a}	1787.50 ± 0.01^{a}
P	125.00 ± 0.00^{b}	115.00 ± 0.00^{b}	192.50 ± 0.00^{b}	162.50 ± 0.00^{b}	218.75 ± 0.00^{b}
Mn	1.88 ± 0.39^{c}	2.50 ± 0.00^{c}	ND	1.25 ± 0.00^{c}	1.88 ± 8.39^{c}
Fe	74.00 ± 0.10^{a}	65.00 ± 0.00^{a}	48.80 ± 2.29^{a}	57.5 ± 6.25^{a}	76.25 ± 1.56^{a}
Zn	ND	ND	0.45 ± 0.01^{c}	ND	ND
Cu	ND	ND	0.17 ± 0.00^{c}	ND	ND

ND = Not detected

Table 1b. *Mineral composition in (mg/kg) of some selected seeds in Imo State*

Parameters	Cinnamon	Parsley	Orima	Fennel	Fenugreek
Mg	1472.50 ± 0.01^{a}	790.00 ± 0.01^{a}	1612.50± 0.01^{a}	1676.88 ± 0.01^{a}	1816.88 ± 0.01^{a}
K	1354.38 ± 0.01^{a}	1947.50 ± 0.02^{a}	1156.25 ± 0.02^{a}	707.88 ± 0.03^{a}	678.00 ± 0.03^{a}
Na	362.30 ± 0.01^{a}	394.33 ± 0.02^{a}	393.33 ± 0.01^{a}	374.33 ± 0.02^{a}	377.30 ± 0.02^{a}
Ca	3048.75 ± 0.50^{a}	2102.5 ± 0.00^{a}	1787.5 ± 0.01^{a}	2628.75 ± 0.02^{a}	1366.25 ± 0.01^{a}
P	55.00 ± 0.00^{b}	127.50 ± 0.00^{b}	212.50 ± 0.00^{b}	213.33 ± 0.02^{b}	207.50 ± 0.00^{b}
Mn	ND	12.35 ± 0.02^{c}	1.25 ± 0.00^{c}	1.75 ± 0.50^{c}	3.25 ± 0.50^{c}
Fe	61.25 ± 0.02^{a}	109.35 ± 0.02^{a}	78.00± 0.01^{a}	105.00 ± 0.03^{a}	104.35 ± 0.02^{a}
Zn	ND	0.36 ± 0.01^{c}	0.89 ± 0.00^{c}	ND	ND
Cu	ND	0.15 ± 0.00^{c}	0.28 ± 0.00^{c}	ND	ND

*Means having the same superscript in a row are not significantly different ($p < 0.05$)

The energy content was highest in country onion leaves (1494.13 ± 0.19 kJ/100g) in line with the carbohydrate content and lowest in celery leaves (707.38 ± 0.01 kJ/100g) as shown in Figure 2.

This finding suggests that the selected ten local spices are good sources of energy for good living of humans and livestock [41].

3.2 Mineral Composition

All the selected spices used in this study

contained appreciable number of metals but celery, mint, bay, country onion, cinnamon, fennel, and fenugreek showed deficiency in Zn and Cu as presented in Tables 1 a and b.

Mineral composition analysis result showed that the spices contained low levels of copper (0.15-0.28 mg/kg), zinc (0.36-0.89 mg/kg), and manganese (1.25-12.35 mg/kg) and high levels of calcium (1366.25-4040.25 mg/kg), magnesium (583.13-3446.28 mg/kg), potassium (666.25-1947.50 mg/kg), sodium (362.30-405.00 mg/kg), phosphorus (55.00-218.75 mg/kg), and iron (48.80-109.35 mg/kg). This result was in line with the work of Fadhil *et al*. [44]. The result further revealed that the spices displayed no significant differences ($p < 0.05$) in magnesium, potassium, sodium, iron, and calcium contents.

Table 2a. *Phytochemical composition of some selected leaves in Imo State (Quantitative)*

Parameter	Celery	Mint	Coriander	Bay	Country onion
Flavonoid (mg/100g)	924.47 ± 0.01	1565.65 ± 0.01	831.41 ± 0.01	7917.65 ± 0.00	868.71 ± 0.00
Saponin (mg/100g)	1077.89 ± 0.01	ND	1313.68 ± 0.01	1947.05 ± 0.01	1446.21 ± 0.00
Terpenoid (mg/100g)	ND	ND	0.74 ± 0.01	2.96 ± 0.01	4.14 ± 0.01
Phenol (mg/100g)	1.42 ± 0.00	1.08 ± 0.01	1.10 ± 0.01	1.86 ± 0.01	0.99 ± 0.01
Alkaloids (mg/100g)	3.72 ± 0.01	3.85 ± 0.01	2.70 ± 0.01	6.25 ± 0.01	6.37 ± 0.01
Cardiac Glycosides (mg/100g)	12.62 ± 0.01	10.50 ± 0.00	13.01 ± 0.01	13.98 ± 0.01	11.30 ± 0.01
Tannins (mg/100g)	ND	ND	0.06 ± 0.01	1.74 ± 0.01	ND
Steroids (mg/100g)	3.83 ± 0.01	1.89 ± 0.01	7.57 ± 0.01	5.60 ± 0.01	8.36 ± 0.00
HCN (mg/kg)	31.20 ± 0.01	54.67 ± 0.01	ND	194.00 ± 0.00	36.00 ± 0.00
Oxalate (%)	450.00 ± 0.01	337.50 ± 0.01	337.50 ± 0.01	337.50 ± 0.00	337.50 ± 0.00
Phytates (%)	0.11 ± 0.00	0.07 ± 0.01	0.09 ± 0.01	0.12 ± 0.01	0.09 ± 0.01

There was high presence of flavonoids in both leaves and seeds but highest in cinnamon seeds (18948.98 ± 0.00 mg/100g) and lowest in fennel seeds (736.29 ± 0.00 mg/100g). The result revealed that the spices contain all the bioactive components except celery, mint, fennel, and fenugreek. However, there was no presence of tannins in celery, mint, country onion, and parsley. Absence of saponins was observed in mint, parsley, and orima. Hydrogen cyanide was also absent in coriander leaves and fennel seeds.

The flavonoids values obtained in this study for celery and bay was higher than the values obtained by Akinola *et al*. [40]. Furthermore, the flavonoids values of spices in this study were higher than other culinary spices used by various researchers [1, 28]. The presence of saponins was highest in cinnamon seeds (2253.63 ± 0.00 mg/100g) and lowest in fenugreek seeds (286.32 ± 0.01 mg/100g).

The result of this study showed that all the selected local spices contained reasonable degree of nutritional values most especially oxalates and phytates and phytochemical constituents which suggest the application of the spices (both leaves and seeds) as supplementary sources of antimicrobial agent and essential nutrients to man and livestock.

Table 2b. *Phytochemical composition of some selected seeds in Imo State (Quantitative)*

Parameter	Cinnamon	Parsley	Orima	Fennel	Fenugreek
Flavonoid (mg/100g)	18948.94 ± 0.00	973.53 ± 0.00	10635.29 ± 0.00	736.29 ± 0.00	3558.88 ± 0.00
Saponin (mg/100g)	2253.63 ± 0.01	ND	ND	676.68 ± 0.01	286.32 ± 0.01
Terpenoid (mg/100g)	19.50 ± 0.01	0.05 ± 0.01	6.43 ± 0.01	ND	ND
Phenol (mg/100g)	1.79 ± 0.01	0.72 ± 0.01	1.30 ± 0.01	1.02 ± 0.01	1.09 ± 0.01
Alkaloids (mg/100g)	4.09 ± 0.01	1.11 ± 0.01	4.80 ± 0.01	3.84 ± 0.01	13.50 ± 0.01
Cardiac Glycosides (mg/100g)	12.00 ± 0.01	12.98 ± 0.01	12.62 ± 0.01	11.00 ± 0.01	8.00 ± 0.01
Tannins (mg/100g)	6.37 ± 0.01	ND	1.81 ± 0.01	3.76 ± 0.01	2.82 ± 0.01
Steroids (mg/100g)	0.96 ± 0.01	5.59 ± 0.01	2.03 ± 0.01	2.17 ± 0.01	3.33 ± 0.01
HCN (mg/kg)	439.03 ± 0.01	89.00 ± 0.01	1287.33 ± 0.01	ND	48.00 ± 0.01
Oxalate (%)	450.00 ± 0.00	225.00 ± 0.00	337.50 ± 0.00	225.00 ± 0.01	337.50 ± 0.01
Phytates (%)	0.10 ± 0.01	0.09 ± 0.01	0.12 ± 0.01	0.10 ± 0.01	0.09 ± 0.01

Terpenoids was relatively low but highest in cinnamon seeds (19.50 ± 0.01 mg/100g). This result was in agreement with other related works [15, 40, 28]. This study observed that the phenolic content of the spices was relatively low with highest value in bay leaves (1.86 ± 0.01 mg/100g) and lowest in parsley (0.72 ± 0.01 mg/100g).

Alkaloids showed highest value in fenugreek seeds (13.50 ± 0.01 mg/100g0 and lowest value in parsley seeds 1.11 ± 0.01 mg/100g). Cardiac glycosides showed highest value in bay leaves (13.98 ± 0.01 mg/100g) and lowest value in fenugreek seeds (8.00 ± 0.01 mg/100g).

Table 2c. *Phytochemical composition of some selected spices in Imo State (Qualitative)*

Parameter	Celery	Mint	Coriander	Bay	Country onion	Cinnamon	Parsley	Orima	Fennel	Fenugreek
Flavonoid	+	+	+	++	+	+++	+	+++	+	++
Saponin	++	-	++	++	++	++	-	-	+	+
Terpenoid	-	-	+	+	+	+	+	+	-	-
Phenol	+	+	+	+	+	+	+	+	+	+
Alkaloids	+	+	+	+	+	+	+	+	+	+
Cardiac Glycosides	++	++	++	++	++	++	++	++	++	+
Tannins	-	-	+	+	-	++	-	+	+	+
Steroids	+	+	++	+	++	+	+	+	+	+
HCN	+	+	-	+	+	++	+	+++	-	+
Oxalate	++	++	++	++	++	++	+	++	+	+
Phytates	+	+	+	+	+	+	+	+	+	+

KEY: +++ = High, ++ = Moderate, + = Low

Tannins were relatively low but highest in cinnamon seeds (6.37 ± 0.01 mg/100g) and lowest in coriander leaves (0.06 ± 0.01 mg/100g).

The steroid content showed highest value in country onion leaves (8.36 ± 0.00 mg/100g) and lowest value in cinnamon seeds (0.96 ± 0.01 mg/100g). The hydrogen cyanide (HCN) content had highest value in orima seeds (1287.33 ± 0.01 mg/100g) and lowest value in celery (31.20 ± 0.01 mg/100g). This study recommends that the orima seeds should be soaked in water for days before use in order to reduce the HCN content.

The oxalate content showed highest values in both celery and cinnamon (450.00 ± 0.01 mg/100g) and lowest value in parsley and fennel (225.00 ± 0.01 mg/100g).

The phytate content was observed to be highest in bay leaves and orima seeds (0.12 ± 0.01 mg/100g) and lowest in mint leaves (0.07 ± 0.01 mg/100g).

The phytochemical assessment has shown that the spices under study displayed rich sources of phytocompounds which can be applied in the synthesis of drugs for the prevention and cure of various diseases [1, 40, 28].

The result of this study with high and low values correlates with previous works [45, 17, 40] which support that bioactive molecules can be used as antioxidants, in allopathic system, cytotoxicity, anti-carcinogen, anti-inflammation, cardiovascular protection, cell proliferation activities, lowering of blood pressure, treatment of congestive heart failure and cardiac arrhythmia, anti-allergic, anti-tumoral activity, anti-microbial activities, treatment of cough, asthma, and hay fever.

More so, the spices under study possessed dietary components such as the oxalate, phytate, flavonoids, used to enhance color, aroma, palatability, and acceptability of food [46].

4. CONCLUSION

The results obtained in this study showed that all the selected plant leaves and seeds contained appreciable amounts of nutrients such as carbohydrate, protein, fibers and minerals. The pharmacological effect of the phytochemical constituents such as alkaloids, cardiac glycoside, carbohydrate and flavonoids as well as the antimicrobial activity of the plant seeds can explain the rationale for the use of these plant seeds in the treatment of infections in traditional medicine. Therefore, the outcome of this research work suggest that the selected spices could be a veritable and cheaper substitute for conventional drugs since the spices are easy to obtain and process. The spices serve as nutritional requirements of both humans and livestock.

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Conflict of Interest Declaration

The authors declare non-existence of any kinds of interest/s whatsoever.

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