International Conference on Sciences, Engineering & Environmental Technology (ICONSEET), 10(15): 101-109, 2023

ISSN 0749-9650

www.repcomseet.org

Product Development: Production of Food Spices from Local Raw Materials and Its Proximate Analysis

Taleat, A. A. T., Abibu M. A. and Adeniyi B. O.
Chemical Science and Technology Department, Federal Polytechnic, Ede.
Correspondence Author: taleat.adewale@federalpolyede.edu.ng, tellawale@gmail.com

Abstract: Herbs, spices and seasonings are materials used as flavouring agents in food products and consumers are constantly hunting for new exciting taste, sensations and seasoning combinations from bold-flavoured herbs in spices. General purpose food spice was produced from fermented locus beans (*Parkia biglobosa*), nutmeg seed (*Mystical frangans*), ginger (*Zingiber officinale*), sent leaves (*Ocimum gratissimum*) and crayfish. The raw materials were dried, pulverized and mixed in different rations to produce an acceptable product named *Locs* spices. The proximate parameters of the raw materials and the product were determined using standard methods of analysis and results were presented in percentages. The moisture content ranged from 10.92 % ±0.08 in nutmeg seed to 12.78 % ±0.08 in ginger, fat content (6.44 % ± 0.12 to 8.78 % ±0.12) in cray fish and ginger respectively. The product (*Locs* spice) had 10.57 % ± 0.16 moisture content,8.38 % ± 0.06 fat content and 18.49 % ± 0.18 protein content. The appreciable fat content in the raw materials may be responsible for the good flavour of the spice. The product (*Locs* spice) aside begin a good and acceptable spice when tested markets is also a good source of protein going by its protein content. However, the price tag on the product seems to be high to most consumers. Mass production will make the product avoidable to many potential consumers.

***Keywords:* Product development, Herbs, Spices, Food, proximate analysis**

1. Introduction

Flavouring agent in whatever forms is important in food preparation either at domestic or industrial levels. Herbs and spices are plant-derived seasonings used for culinary purposes. The terms: herbs and spices are often used interchangeably, but their botanical definition is different. Herbs store flavor component in leaves, while spices store theirs in seeds, bark, and root. A spice may be the bud (clove), bark (cinnamon), root (ginger), aromatic seed (cumin), and flower stigma (saffron) of a plant. In addition to making food taste good, culinary spices have been used as food preservatives and for their health-enhancing properties for centuries (Ogbunugafor *et al*, 2017). Spices are also known to stimulate, appetite and create visual appeals to food (Ogbonna *et al*., 2015).

The phytochemicals are bioactive compounds found in different parts of the plant have been characterized These compounds are not vitamins or minerals but are plants' constituents that work with other nutrients and dietary fibers to prevent and protect
against diseases i.e as allelochemicals (Chiwendu *et al.*, 2016). The constituents of herbs and spices function as defense chemicals to repel insects, snails, and other predators from the host plants. They sometimes contain allelochemicals which inhibit the growth of some other plants species in the of plants immediate environment (Linhart *et al*., 2015). Spices and herbs are functional foods that are beneficial to certain target functions in the body beyond basic nutritional requirements. Spices occur in a variety of flavor, color, and aroma contributing a wide range of nutrients to foods (Mann, 2011).

The spice industry is a low technology business with very low barriers to entry. Almost any small business can enter and compete. The primary requirements to get product to market are

raw materials, containers and a means to fill and label them. The raw materials are agricultural products, produced by numerous small farmers around the world.

Fermented locust beans is a common traditional condiment in Nigeria, and other West African countries. It is called *iru* in Yoruba land, *dawa dawa* in Hausa, and *ogiri okpe* in Igbo. Most traditional stews, sauces and soups will not be complete without this pungent condiment. Locust beans are seeds obtained from the pods of the African locust tree; *Parkia biglobosa*, which belongs to the family *Mimosaceae.* African locust bean is sometimes called carob because of the similarities in appearance, but they are different from each other. Carob comes from *Ceratonia siliqua* tree, which is typically found in the Mediterranean. It is also called Mediterranean locust beans, which explains the confusion between the two (Okokon *et al*., 2007).

Most of the parts of the African locust beans are utilized as food in one form or the other in West Africa, with the most prominent being the seeds. These are fermented into the condiment, *iru* (*dawa dawa*). *Iru* (*dawa dawa*) is used to flavour stews, sauces and other dishes like rice, native salads etc. It was one of the main condiments used in West Africa before seasoning cubes, and it is still a good alternative to bouillon cubes because of its nutritional and health benefits. It has a pungent aroma which is not particularly attractive, but in a sauce or stew, the flavour enhances the taste so much. A small amount of fermented locust beans in okro soup, *ewedu, egusi* soup or *efo riro*, and obe ata dindin (sauces) enhance the taste in a delightful way (Akande *et al*., 2010).

Fresh iru can be stored in the fridge for a few weeks and will keep for months the freezer. Dried Iru will keep in a cool and dry place for months. It should be stored in an air-tight container to stop the smell taking over the storage area.

Figure 1: Fermented African Locust Beans - Iru / Dawa dawa

Ginger (*Zingiber officinale*) has been used as a medicinal plant worldwide, since ancient times, for the traditional treatment of cramps, rheumatism, sprains, sore throats, pains, constipation, vomiting, hypertension, indigestion, wound, and fever. Ginger has a long history of being used as a medicine and herbal since ancient time and had been used as an important cooking spice throughout the world (Nwakwo *et al*. 2014).

Some of the countries grow with variation in species viz: Indian, Nepal, Bangladesh, Sri Lanka ginger – (Z. officinale), Jamaican ginger – (Z. officinale), Chinese ginger – (Asarum splendens), Australian ginger – (Alpinia caerulea), Nigerian ginger – (Z. officinale white and yellow variety), Japanese ginger – (Zingiber mioga), Indonesian ginger – (Alpinia galangal), and Hawaiian Island – (Zingiber zerumbet) (Prasath, 2021). Other notable member of this family (Zingiberacea) is turmeric otherwise called red ginger (Curcuma longa) (Adeyemi,

2011). Ginger has direct anti-microbial activity and thus can be used as preservative (Arshad *et al*. 2014).

Previous pharmacological studies showed ginger to have different biological activities such as antibacterial activity, anti-fungal activity and anti-inflammatory activity (Aldebasi *et al*., 2013). Previous studies on phytochemical and antibacterial properties of *Z. officinale* had been carried out (Hasan *et al*., 2019);(Jiang *et al* 2018).

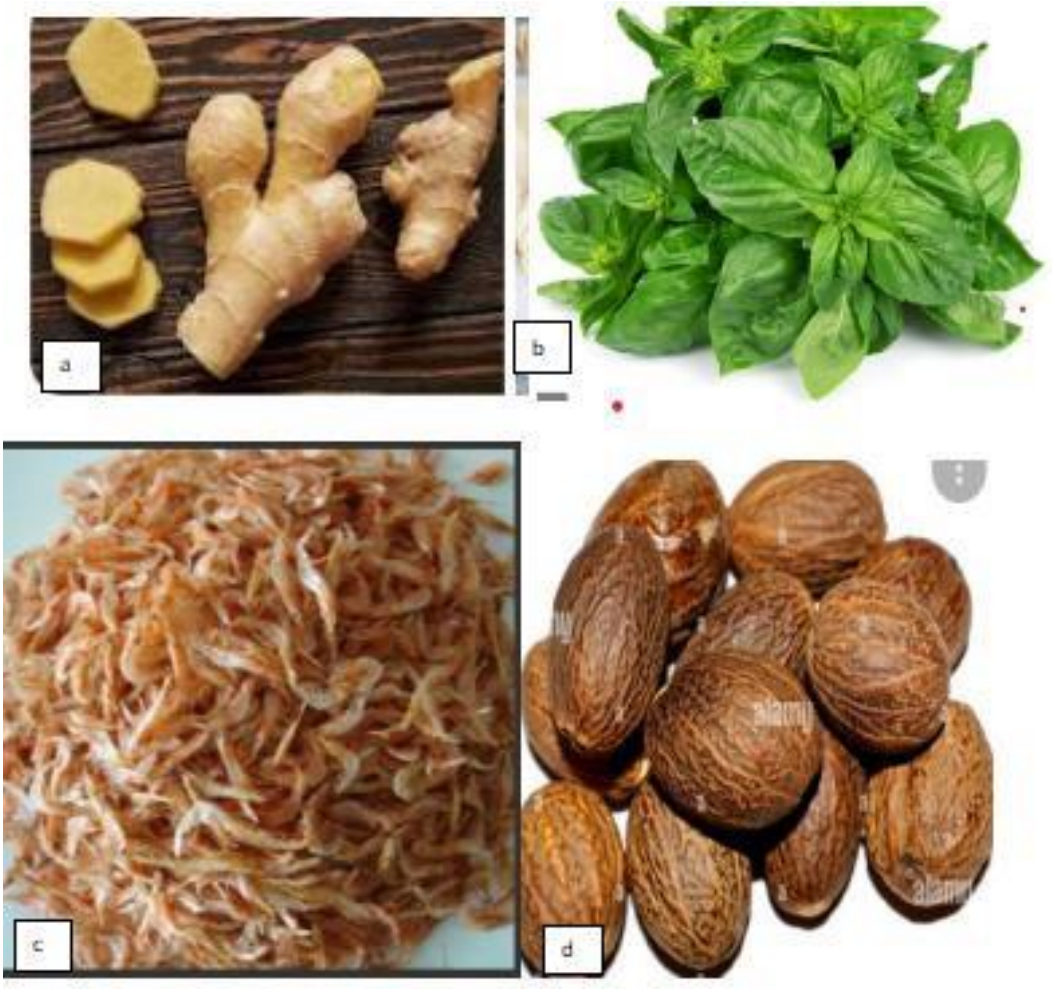

Figure 2: Raw Ingredients- (a) Ginger, (b) Scent leaves, ©- Crayfish, (d)-Nutmeg seeds

Ginger extract can remove disorders caused by oxidative stresses as a strong anti-oxidant. Studies have shown that extant phenolic compounds and anthocyanins including gingerols and the sugevals had many neuro-protective effects such as analgesic effects, memory improvement, and learning caused by the aging process (Jiang *et al*., 2018). For culinary purposes ginger is suitable for all foods.

Scent leaf (*O. gratissimum*), the African variety of basil (*Ocimum sp*), is widely grown as a perennial herb in tropical Africa, South East Asia, India and Hawaii. It is highly recognized worldwide due to its versatile nutritional, anesthetic, and medicinal uses noted that scent leaf is rich in alkaloids, tannins, phytates, flavonoids, terpenoids, oligosaccharides, thymol and saponin, with tolerable cyanogenic content. *Ocimum basilicum* is a common herb that is known for its ornamental and therapeutic importance. The chemical constituents which

have been isolated from the plant include terpenoids, alkaloids, flavonoids, tannins, saponin glycosides and ascorbic acid. It has been reported to be hepatoprotective, immunomodulatory, antihyperglycemic, hypolipidemic, antitoxic, anti-inflammatory, antibacterial and antifungal. (Ref.).

Nutmeg (*Myristica fragrans*) is an evergreen tree belonging to family *Myristicaceae*, a family of flowering plants indigenous to Asia, Africa, Pacific islands, and America (Bellik, 2014) and has been known by most taxonomists. It is occasionally called the nutmeg family, due to its well known member, *Myristica fragrans*, the source of the spices nutmeg and mace. Nutmeg contains fats (30-40%) and essential oils (10%). Essential oil is generally characterized by GC-MS analysis [3-7]. The distinctive odor of nutmeg is due to presence of essential oil which contains terpenes (α-pinene, p-cymene, sabinene, camphene, myrcene and γ-terpinene) terpene derivatives (terpinol, geraniol, and linalool) and phenylpropanes (myricticin, safrole, and elmicin). Crayfish (Ahmad *et al*.,2013): (Andrew *et al*., 2016) The present study aimed to produce fermented locust beans spices devoid of bad odour with enhanced shelf life and nutritional value.

2.0 Methodology

2.1 Raw materials collection

The raw materials (raw locust beans, Basil leaves, Ginger rhizome, nutmeg seed and dried crayfish) were obtained from *Timi* market in Ede and were processed at the Federal Polytechnic Ede, Osun State using the traditional method.

2.2 Preparation of fermented Locust beans

The African locust beans were soaked in water for 2hrs to de-pulp the seed and boiled for 10 hours. After the boiling, the water was sieved to obtained pure substrate (Seed), the seeds were de-hulled by rubbing in between the palms to obtain a cotyledon. The chaffs were removed from the cotyledon by the use of sieve and washed with excess water. The cotyledons were divided into two equal parts, one was preserved in fridge, and the other part was kept for fermentation process. The hot water was sieved and the obtained cotyledons were put in a calabash, covered and wrapped with sack and left to ferment for 48 hrs at room temperature (Akande *et al*.,2010).

The dried raw materials: fermented locust beans, scent leaves, cray fish and grated nutmeg seed were separately powdered and mixed in different proportions with the powdered locust bean forming the base (in highest proportion). The blended formulations were subjected to acceptability tests and the most acceptable formulation was branded as *Loc's Spices* (a multipurpose spices for food seasoning). The dried powdered raw materials were blended in different ratio (formulation) and the acceptability test was performed on different blends by panels comprising of students and house wives. The best formulation was adopted for the production of the spices product. The product was branded and named *Locs spices blend* and the proximate analysis of the product and ingredient were performed using standard analytical methods (AOAC, 2005) ;(Oguoma *et al*.,2015).

2.3 Proximate Composition

2.3.1 Moisture Content Determination by Oven Drying Method (Gravimetry)

The moisture content was determined by drying samples (Sample A = Cray Fish, Sample B = Nut meg, Sample C = Scent Leaf, Sample D = Product, Sample E = Locust Bean) overnight at 105 ^{0}C for 2hrs 30min. The empty labeled evaporating dishes were washed, dried in the oven, allowed to cool in a desiccator and the weight of empty dish was noted (W1). Approximately 2g of each of the sample was weighed into the dish by difference as dish (W2). The dishes with the samples were then dried in the oven at 105 ^{0}C for first one hour. The samples were finally dried to a constant weight (W3) and moisture content calculated. Each sample determination was performed in triplicate and the average value was determined

$$\% \text{ Mois Ms} = \frac{(W - W)}{W - W}$$

2.3.2. Ash content Determination

Ash content is the inorganic residue remaining in the food sample after removing the organic matter by burning at high temperature, around 550°C, in a muffle furnace. The weight loss of the ashed sample is taken as the ash content of the sample (in percentage). However, care must be taken to prevent loss of ash. Approximately one gram (1.0g) of samples was weighed into clean, dried and pre-weighed crucibles (W1). The content with the crucibles were then weighed (W2). The organic matter was burnt off on the Bunsen flame until the samples became charred. The crucibles were then transferred into a muffle furnace at 550º C for five hours. Ashing was continued until a light grey or white ash was obtained. The crucibles were then cooled in a desiccator and weighed (W3). The determination for each sample was done in triplicate and the average value determined.

$$\% \text{ o} = \frac{(W - W)}{W - W}$$

2.3.3 Fat Content Determination by Hot Extraction Method (Soxhlet Extraction)

The crude fat of the samples is determined by weighing an empty filter paper (W1) adding some quantity of the sample into the filter paper and weighed with its content as (W2). N- hexane was put in the round bottom flask of the *soxhlet* apparatus; the set up was heated and made to reflux for at least 6 hours. The sample was removed thereafter, dried and re-weighed with the filter paper (W3). Each determination was performed in triplicate and the average value determined.

$$\% \text{ i F} = \frac{(W - W)}{W - W}$$

2.3.4 Protein Content Determination (Kejdahl method)

The protein content of foods can be estimated from the organic nitrogen content determined by the *Kjedahl* procedure, which was carried out in three steps:

Digestion: The first step involved the digestion in which l.0g of the sample was digested with concentrated H_2SO_4 (l0ml) in a dry 500ml *Kjedahl* digestion flask together with 0.8g of digestion catalyst mixture (400g of Na_2S0_4, 16g of hydrated $CuSO_4$ and 3g of selenium dioxide). The mixture was then swirled together and the flask was fitted with a loose pair stopper in an inclined position. It was then placed in a fume cupboard and heat was increased and the mixture was swirled and shake from time to time in order to wash down any charred adhering to the flask. The mixture was heated until clear solution was obtained. The flask was allowed to cool, after which the solution was diluted with fresh tap water to 100ml of which 10ml was transferred into *Kjedahl* distillation flask.

Distillation: This involves steam distillation of the cooled, diluted, digested sample to which 25 ml of 40% NaOH was added to make it alkaline. The cloudy nature of the sample solution after the addition of 40% NaOH indicated that NaOH was in excess. To the receiving flask, 5ml of 2% boric acid solution was added and few drops of screen methyl red indicator (0.016g of methyl red and 0.083g of bromocresol green were dissolved in 100ml of alcohol) was also added to produce a pink colour solution. The distillation was carried out with all joints tightened with the end of the delivery tube dipping below the boric acid solution. As the distillation proceeds, the pink colour of receiver turned deep green indicating the presence of NH_3. Distillation continued until the distillate was about 50 ml after which the delivery end of the condenser was rinsed with distilled water into the receiver.

Titration: The final stage involves titration in which NH_3 received in the acid solution was titrated with 0.1M HC1 solution. A blank was also carried out.

$$NH_4^+ \; H_2BO_3^- + H^+C1^- \longrightarrow NH_4Cl + H_3B0_3$$

Colour changes from green to pink.

$$\%\,\mathbf{M} = \frac{\mathbf{MFa\ r\ .\ Mis\ r\ iM\ M}}{\mathbf{st\ as}\,()}$$

Crude protein = %N x 6.25

Where: 6.25 is a general factor of food sample.

2.3.5 Crude Fibre Determination

The de-fatted and dried sample was weighed (0.5 g) and poured into a round bottom flask containing 200 ml of boiling 0.25M sulphuric acid solution. The round bottom flask was connected to a condenser and brought to boil within a minute. Refluxing was done for 30 minutes with periodic swirling of the flask to remove particles adhering to the sides. This was filtered within 10 minutes using a preheated Buchner flask. The residue on the filter paper was washed with boiling water and the residue was transferred back into a clean round bottom flask containing 200 ml of boiling 0.50M sodium hydroxide and refluxing was again carried out for 30 minutes. The mixture was filtered within 10 minutes in a preheated Buchner flask. The residue was washed with boiling water, with 1% HCl solution and then again with boiling water and finally with petroleum ether. The residue was then transferred into a pre-weighed crucible and oven dried at 105 ^{0}C until constant weight, the weight was recorded. The crucible was immediately transferred into a muffle furnace operated at 550 ^{0}C for 3 hours, and then left to cool in a desiccator and weighed again. The weight of the sample was taken.

2.3.6 Carbohydrate Determination

The carbohydrate was determined by the method of difference. The percentage carbohydrate content is equal to the sum of the percentage of moisture, protein, ash, fibre and fat contents subtracted from 100.

% Carbohydrate content = 100 - (% moisture + %ash+% protein % fat + % fibre)

3.0 Results and Discussion

3.1 Results

Table 1: Proximate Composition (%) of Samples (Ginger & Nutmeg, Crayfish, Locust Beans, Scent Leaf and *Loc's Spices (*Product)).

SAMPLE	MC	FC	AC	FIBRE	PRO	CHO
A	12.78±0.08	8.78±0.12	20.57±0.08	1.27±0.06	18.92±0.48	37.69±0.42
B	10.92±0.08	8.16±0.04	9.90±0.03	1.11±0.04	20.63±0.64	48.84+0.75
C	12.69±0.05	6.44±0.08	13.95±0.05	1.39±0.11	13.05±0.89	52.73±0.20
D	11.95±0.16	13.19±0.04	2.20±0.01	2.13±0.08	10.38+0.48	70.07±0.91
E	10.57±0.08	8.38±0.06	12.65±0.09	46.02±63.61	18.49+0.18	48.97±0.36

NOTE: MC = Moisture content, FC = Fat Content, AC = Ash Content, FIBRE = Crude Fibre, PRO = Crude protein, CHO = Carbohydrate

3.2 Discussion

The results of the proximate analysis of samples (ingredients and product) as shown in Table revealed that the Carbohydrate content of the *Loc's spice* (sample D) was the highest (70.07±0.91). This is and indication that the raw ingredients composed of substantial amount of carbohydrate. The lowest amount of carbohydrate recorded in sample A (Cray fish) (37.69±0.42) could be traced to its origin (since it is the only raw ingredient sourced from animal). The results also showed that the Fibre content of all the samples were very low except sample E (fermented locust Bean powder) that have an appreciable amount of Fibre (46.02+63.61) (Okoye and Ebeledike, 2013) :(Olaofe *et al*., 2010). The appreciable fibre content in sample E could possibly be traced to some seed coats left in the beans. The moisture content of all samples were appreciably low (below 10 %) except A (dried Cray fish powder) which has 12.78±0.08. The low moisture content will enhance the shelf life of both the ingredients and the finished product (*Loc's spice*). Sample B (Powdered nutmeg seed) had the highest amount of protein (20.63±0.64). However, the amount protein recorded for nutmeg seed in the present study was lower than the value recorded in previous study (Ajegena, 2020).

Crude fat is known as crude mixture of fat-soluble material present in sample. They are often labeled "heart-healthy" and recommended as an alternative to sources of saturated fat, such as butter, lard and tallow. In addition, the reason why they are considered heart-healthy is that studies have revealed that it has helped in reducing risk of heart problems. And in this study, Sample D have more appreciable amount of crude fat (13.19±0.04) than the remaining of the samples. Although, high level of crude fat can cause inflammation of the pancreas, high blood pressure and abnormal function of the heart.

4.0 Conclusion

Acceptable general purpose spice (seasoning) product (Loc's spices) has been produced from locally sourced raw materials. The chemical analysis of the product indicated that it has enhanced nutritional value that the ingredients. The study also revealed that acceptable spice can be produced from fermented locust beans devoid of unpleasant smell with long shelf life. It is therefore recommended that value addition can be brought to the semi dried fermented locust beans (*Iru*) used as local condiment by dehydration.

References

Adeyemi, M. M. H. (2011). A review of secondary metabolites from plant materials for post harvesting. *International Journal of Pure and Applied Science and Technology* 6: 94– 102.

Ahmad, S. M., Birnin-Yauri, U. A., Bagudo, B. U. & Sahabi, D. M (2013) Comparative analysis on the nutritional values of crayfish and some insects. *Afri. J. food Sc. Technol.*, 4(1), 9-12

Akande, F.B., Adejumo O.A., Adamade, C.A and Bodunde J. (2010). Processing of locust bean fruits: challenges and prospects. African journals of Agricultural Research. Vol. 5 (17): 2268-2271.http://www.academicjournal.org/AJAR

Aldebasi Y. H, Aly S. M, Rahmani A. H. (2013). Therapeutic Implications of Curcumin in the Prevention of Diabetic Retinopathy via Modulation of Anti-Oxidant Activity and Genetic pathways. *Int J Physiol Pathophysiol Pharmacol*; 5: 203-215.

Andrew, O., Jori, B., Deborah, D. & Lori, S (2016) Health benefit of eating sea foods. Health fitness Resoltion (HFR). www.healthfitnessresolution.com. Retrieved 10/18/2016 AOAC. (2005) Official Method of Analysis. Association of Official Analytical Chemistry Washington DC pp 205-610.

AOAC (2010). (Analysis of Association of Official Analytical Chemists).16th edition. Washington, D.C., USA

Arshad H Rahmani, Fahad M Al shabrmi, Salah M Aly (2014). Active ingredients of ginger as potential candidates in the prevention and treatment of diseases via modulation of biological activities. *Int J Physiol Pathophysiol Pharmacol*;6(2):125-136 ww.ijppp.org

Chiwendu, S., Ejike, E. N., Ejeke, B. U., Oti, W., Uwachukwu, I. (2016). Phytochemical constituents in health and commonly used spices in Nigerian dishes and snacks. effects of *Thymus vulgaris* (Lamiaceae) terpenes on associated species. *International* ExtractsIsolated from *Zingiber Officinale* by Different Solvents. *Pharmaceute Anat* Generation Horticulture (September 16-19).

Hasan H.A., Rasheed Raauf A.M., Abd Razik B.M., Rasool Hassan B.A. (2012). Pharmaceutical, Chemical Composition and Antimicrobial Activity of the Crude ExtractsIsolated from *Zingiber Officinale* by Different Solvents. *Pharmaceute Anat Acta*; 3: 184.

Jiang Y. Huang M., Wisniewski M., Li H., Zhang M., Tao X., Liu Y., Zou Y (2018). Transcriptome analysis provide insight into gingerol biosynthesis in ginger (*Zingiber oficinale*). *Plant Genome:*11 (3). doi: 10.3835/plantgenome201 PMID: 30512040.

Linhart, Y. B., Gauthier, P., Keefover-Ring, K., Thonpson, J. D. (2015). Variable phytotoxic effects of *Thymus vulgaris* (Lamiaceae) terpenes on associated species. *International Journal Plant Science* 176: 20–30.
Mann, A. (2011). Biopotency role of culinary spices and herbs and their chemical constituents in health and commonly used spices in Nigerian dishes and snacks. *African Journal of Food Science* 5: 111–124.
Nwakwo, C. S., Ebenezer, I. A., Ikpeama, A. I., Asuzu, F. O. (2014). The nutritional and antinutritional values of two culinary herbs – uziza leaf (*Piper guineese*) and scent leaf (*Ocimum gratissimum*) popularly used in Nigeria. *International Journal of Science Engineering Reseach*, 5: 1160–1163.
Ogbonna, A. C., Abuajah, C. I., Hart, E. B. (2015). Preliminary evaluation of physical and chemical properties of *Piper guineense* and *Xylopia autheopica* seed oils.
International Food Research Journal 22: 1404–1409.
Ogbunugafor H. A., Ugochukwu C. G. and Kyrian-Ogbonna A. E.(2017). The role of spices

in nutrition and health: a review of three popular spices used in Southern Nigeria. F***ood Quality and Safety***, 1–15 doi:10.1093/fqsafe/fyx020.

Oguoma, O. I., Ezeifeka, G. O., Adeleye, S. A., Oranusi, S., Amadi, E. S. (2015). Antimicrobial activity, proximate and amino acid analysis of *T. tetraptera*. *Nigerian Journal of Microbiology* 27: 2709–2718.

Okokon, J. E., Udokpoh, A. E., Antia, B. S. (2007). Antimalaria activity of ethanolic extract of *Tetrapleura tetraptera* fruit. *Journal of Ethnopharmacology* 111: 537–540

Okoye, E. I., Ebeledike, A. O. O. (2013). Phytochemical constituents of *Piper guineense* (Uziza) and their health implications on some microorganisms. *Global Research of Journal Science* 2: 42–46.

Olaofe. O., Famurewa, J.A.V., Ekuagbere, A.O. (2010). Chemical and functional properties of kidney bean seed flour. International Journal of Chemical Sciences, 3: 51-68

Prasath D., Shivakumar M.S., Sivaranjani R. and Aarthi S. (2021). Breeding next generation spices for nutraceuticals. Compendium of International Horticulture Conference Next Generation Horticulture (September 16-19).