



Nutritional Profile and Sensory Evaluation of Synthesized Food Spice (*Lippia multiflora*, Scent leaves (*Ocimum gratissimum*) and African black pepper (*Piper nigrum*)

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Abstract

Spice being the product of dried fruit, seed root, bark, or vegetative substances, are primarily used for flavoring, coloring, and preserving foods. This study investigated some physico-chemical composition and sensory acceptability of food spice produced from *Lippia multiflora* leaves, scent leaves (*O. gratissimum*) and black pepper (*Piper nigrum*) seeds. The proximate composition revealed that the spice had a moisture content of 9.3%; protein content of 11.18%; ash content of 3.3%; crude fibre content of 3.4%; fat content of 15.33% and carbohydrate content of 57.5%.

The spice had considerable amounts of phosphorus (135.3 ppm), potassium (319.2 ppm), calcium (64.3 ppm) and magnesium (157.2 ppm), while lead and Iron were low and copper was absent.

The phytate, oxalate and tannin values for the food spice were 0.71 mg/100g, 1.2 mg/100g and 0.51 mg/100 g respectively.

The pH, titratable acidity, solubility, water absorption capacity, bulk density and swelling power were 6.19, 1.15%, 6.48%, 3.17 mL/g, 0.74 g/mL and 14.96 g/g respectively. The spice compared favourably with available established commercial food spice in terms of taste, flavour and overall acceptability.

These results indicate that the spice had good physicochemical attributes and contains appreciable amount of food nutrients which can find suitable application in nutrition and food processing.

Keywords: Spice, Flavour, Digestion Acceptability, Health.

Introduction

Spices are aromatic or pungent dried vegetable substances used primarily to season food. Parts of plants from which they are derived include the dried form of various barks, the flowers, the roots, the seeds, and the fruits. They could be coloured, aromatic, phenolic, or pungent. The best known use of spices is in food preparation and cooking. One of the best things about spices is that when prepared, dried, and stored properly, they can last almost forever. Also, since they are so low in calories, being ground up in tiny forms, there is no danger of any side effects. They contain proteins and organic compounds that are necessary for overall health (Adou *et al.*, 2012; Parthasarathy *et al.*, 2008; Srinivasan, 2007).

Spices have been used since ancient civilization, their flavour and properties make them important for culinary and medicinal uses (Adou *et al.*, 2012; Parthasarathy *et al.*, 2008). Since past times, several countries had fought for the control of spice trade but the strongest nations have been the ones who manage the spice trade.

Spices, depending on the origin and active principle present are classified as pungent spices, aromatic fruits, aromatic barks, phenolic spices and coloured spices (Manay and Shadaskarswamy, 1999).

Lippia multiflora Mondenke (savanna tea) is a woody shrub in tropical ecologies, with increasing interest because of its biomedical virtues: Tea-like infusions are traditionally used as remedy against malaria fever, stress, hypertension, gastro-intestinal trouble and cough as well as laxative (Noamesi *et al.*, 1985); Traditionally Africa black pepper is believed to have medicinal properties and this has led modern-day researchers to study its extracts. It is used in Western African cuisine where it imparts 'heat' (piquantness) and a spicy pungent aroma to West African soup (stew) (Katzner and Gernot 2015; Lai & Roy, 2004; Kunle *et al.*, 2003). The leaves are used as a spice to flavor meat preparation and fresh pepper soup. They are also processed and consumed as vegetables in meals (Adjanohoun & Souza, 2002; Khamum *et al.*, 2001). The fruits are used as a spice to flavour soup, rice, and stew. In Nigeria, the leaves have been shown to have antibacterial activity.

Spices are used traditionally for aroma and as preservatives. Spices are used to cover spoiled meat flavour, improve colour and flavour and of late to improve shelf life of foods (Khanum *et al.*, 2001). Although spices are used primarily to enhance the taste of otherwise bland foods, their beneficial effects stretch far beyond our tongues (Ezenobi *et al.*, 2016; Coffiet *et al.*, 2003).

The advantages of spice and their products like powders of spices, spice extracts, tea etc. are sterile, free from extraneous materials, soluble in a variety of systems, stable under good storage conditions and represent up to 98 per cent savings in weight and storage space (Hassel *et al.*, 2001; Khanum *et al.*, 2001). Food spices play a crucial role in culinary practices, and their chemical composition affects their sensory attributes. *Lippia multiflora*, scent leaves and African black pepper seeds are commonly used spices in traditional African cuisine. This study aimed to evaluate the chemical and some physicochemical composition as well as sensory acceptability of the spices derived from *Lippia multiflora* leaves, Scent leaves and African black pepper.

Materials and Methods

➤ Source of Materials

Leaves of *Lippia multiflora* and *O. gratissimum* and iyere seeds (African black pepper) were procured from local plant breeders within Ekiti State Agricultural Development Project (ADP) farms, close to Aba Erinfun, Ikare Road, Ado Ekiti, Ekiti State, Nigeria.

The leaves were identified at the Department of Botany (Herbarium unit), Ekiti State University, Ado Ekiti with a further confirmation at the Herbarium unit of Afe Babalola University, Ado Ekiti (ABUAD).

➤ Sample Processing

The leaves of *L. multiflora* and *O. gratissimum* were sorted to remove extraneous matter, while the iyere seeds was cleaned thoroughly. The sorted leaves, and iyere seeds were air dried, milled, and sieved individually.

The spice was then prepared from the raw materials in the following proportion:

- 60g of *L. multiflora*
- 20g of *O. gratissimum*
- 20g of Black pepper

The mix was thoroughly homogenized and packaged in air tight plastic containers and polyethylene bags.

All the parameters analyzed was done in triplicates, and the mean of the triplicate determination was taken as the representative results.

➤ Proximate Composition Determination

The moisture, crude protein, crude fibre, total ash and fat content of the processed spice were determined using the method of AOAC (2023). The carbohydrate content was determined by difference obtained after subtracting total organic nitrogen (protein), Lipid, Ash, Moisture and Fibre from the total dry matter.

The calorie value estimation was obtained by summing the multiplied values for crude protein, fat and carbohydrates (excluding crude fiber) by their respective AT WATER factors (4, 9, 4) respectively (Antia *et al.*, 2006),

➤ Determination of Functional Properties

The pH, total acidity, bulk density, swelling power, water absorption capacity of the processed spice was determined using the methods of AOAC (2023), Oladele *et al* (2007), Adebawale *et al* (2012) respectively.

➤ **Phytochemical Screening**

Tannins, trypsin inhibitors, saponin, phytate, alkaloid, flavonoids, phenols, and oxalate of the processed food spice was determined using the method as described by AOAC (2023); Coffi et al (2003) and involves spectrophotometric evaluation, gravimetric, double extraction gravimetric, colorimetric, alkaline precipitation methods respectively.

➤ **Sensory Assessment**

The sensory evaluation of the synthesized spice was carried out by 20 semi-trained panelists consisting of students of the Federal Polytechnic Ado-Ekiti. The samples were evaluated in terms of colour, aroma, taste and overall acceptability.

Results and Discussion

➤ **Proximate Composition and Calorie Value of Synthesized Food Spice**

The proximate composition of the processed food spice and its calorie value is shown in Table 1. The spice had low moisture content 9.3% implying that the spice has better storage index which helps to reduce postharvest losses, dried vegetables generally have reduced water content, whereas, vegetables are known generally to have high moisture content, a factor implicated for its high perish-ability.

Crude protein content was 11.18% which is high, protein is known to be very important and essential for the repair and maintenance of body cells in higher animals. The spice had low fiber (3.4%) and high carbohydrates content (57.5%), non-starchy vegetables are the richest sources of dietary fibre, and it's a veritable tool in the treatment of diabetes and obesity (Ezenobi et al., 2016; Saldanha, 1995). The ash content was low (3.3%), implying that the spice has moderate proportions of mineral elements (Antia *et al*, 2006).

The percentage fat content is high (15.3) for a predominantly vegetable product. Dietary fats functions in the increase in foods palatability of foods by absorption and retention of flavours. A diet that can provide 1-2% calorific energy as fat is sufficient for humans, since excess fat is implicated in some cardio-vascular ailments and ageing (Antia and Akpan 2006).

These results reveal that compared to the commercial spice, this processed spice has adequate nutrients to satisfy calorie and protein demands of the populations. Furthermore, the rich proximate composition of this traditionally processed spice can be explored in food processing for food formulation and fortification.

➤ **Elemental composition of synthesized food spice**

Table 2 shows the mineral elements in the food spice. The spice had appreciable amounts of minerals, especially phosphorus, potassium, sodium and calcium. The mineral content of this processed is generally higher than those reported for some other plants (Andaulem & Gesseesse, 2014). It has the potential to supply sufficient amount of minerals. It has high contents of Ca, K, Mg, Na, P, Zn and Fe respectively, however, it had low Cu, while Hg was not detected in the

food spice. Phosphorus is an essential component of all cell division, reproduction and heredity. In addition Ca and P combine to prevent rickets (Hangen & Bennin 2002).

High K and Na ratio in foods serves as maintenance of a correct osmotic pressure and fluid pH in the body, essential for the movement of metabolites (Lake and Waterworth, 1980). Calcium was high (64.3 ppm). Calcium plays important roles in tissues and bones strengthening.

Olaofe *et al.*, (1987) suggested that soil composition may be a major factor influencing mineral uptake in plants. Iron content was moderately high (3.02 ppm), iron deficiency is one of the most prevalent nutritional issues in developing countries, often arising from poor bioavailability of iron in the diets (WHO-UNICEF, 1993). This deficiency reduces work capacity and productivity in adult, increases the severity and incidence of infection, anemia, material and prenatal mortality (Scrimshaw, 1991). The magnesium content obtained in the spice was high (157.2 pm). Magnesium helps to maintain normal nerve and muscle functions and supports a healthy immune system

➤ Some Physico-chemical Properties of Synthesized Food Spice

Some functional properties of the processed spice are shown in Table 3. pH was 6.17, slightly acidic and tending to almost neutral pH implying that enzymes reactions are activated (Ihenkoroye and Ngoddy 1985).

Solubility and swelling power were 6.48 and 14.96 respectively. The swelling power implies that the spice flour can swell-up to fourteen times its original volume in hot water as posited by Tester *et al.*, (1990) and may be as a function of a starch's amylopectin chain. The swelling power of the sample was higher than 2.16 reported for cassava flour (Okezie and Bello, 1998). Since the swelling power of the spice is high, it suggest it may find application in food production (Mc-comick *et al.* 1991)

Water absorption in the sample was 3.17. which can be considered moderate. High water absorption capacity is an index of flour characterization quality for industrial purposes (Microsoft Encarta Encyclopedia, 2005).

The water absorption of flour is a useful indicator of, whether protein can be incorporated with aqueous food formulation especially those involving dough handling (Osungbaro *et al.*, 2010). The moderate water absorption capacity of the flour of this spice suggested they could be useful in soup formulations (Olaofe *et al.*, 1998).

The physicochemical properties of the synthesized spice compared favourably with that of the commercial spice used as control.

➤ Some Anti-nutritional Factors in Synthesized Food Spice

Table 4 presents the anti-nutritional factors of the food spices. Phytates, oxalates and tannin were found to be 0.71, 1.2 and 0.51 mg/100g respectively, which is much lower to that of the commercial spice 0.78, 2.6 & 2.5 respectively.

The presence of anti-nutritional factors in the samples is of significant importance since they are known to have some deleterious effects on both humans and other animals.

Oxalate is a chelating agent, which binds calcium very effectively. Plants with high oxalate content may produce acute metabolic calcium deficiency (Hypocalcemia) when such plant products are used as a main food source (Andualem and Gessesse, 2014). One of the main health concerns about oxalate is that it can bind to minerals in the gut and prevent the body from absorbing them. The concentration of oxalate (1.2 mg/100g) in the present study seems to be on the low side when compared to reported values in some plants (Umoren *et al*, 2005).

Tannin is known to evoke growth-depressing effects in rats. In this study, the tannin level for the food spice (0.51 mg/100g) is relatively low in comparison with tannic acid in some literatures (Akinyede *et al*. 2005; Enujiugha 2003; Umoren *et al*. 2005), the tannin content of the samples in this study is less than the tannin content of some dry plants (84.3 mg/100g) as reported by Andualem and Gessesse (2014).

The tannin content of this spice may not be as such harmful, as expected for consumption. High amount of tannins are well known to form complex with proteins and reduce the solubility of proteins, hereby making the protein less susceptible to proteolytic attack than the same proteins alone. However, relatively, some amount of tannin may have a potential role as protective factors against free radical mediated pathologies, such as cancer and atherosclerosis, in humans (Hangen and Bennin. 2002).

➤ Sensory Evaluation of processed food spice

The sensory evaluation of the processed spice is shown in Table 5. The overall acceptability of the processed spice used in cooking meat and fresh fish was generally higher than the control, which was regular spice procured from local markets in Ado town.

Conclusions

It can be seen from the results that the traditionally processed food spices had richer chemical and elemental composition in relation to some plants, particularly its crude oil and protein contents. In literature, protein is essential for growth, repair and maintenance of body cells and functions. The amount of protein in the spice is high compared to that of most protein rich crops. However, it may not serve as good source for carbohydrates compared to other food sources.

Generally, the spice showed considerably high nutrients and in addition to other food sources, the proximate composition and mineral content of the spice blend revealed a nutrient-rich product with potential to enhance food flavor and aroma.

This can also help in post-harvest losses by utilizing otherwise wasted herbs and spices, while also contributing to food security by providing an affordable and accessible seasoning option for Nigerian consumers.

Table 1: Proximate Composition and Calorie Value of Synthesized Spice

Parameter %	Synthesized Spice	Commercial Spice
Moisture Content	9.3 ±0.45	11.8 ± 0.36
Crude Protein	11.18 ±0.26	2.2 ± 0.42
Ash Content	3.3 ±0.45	4.8 ±0.45
Fat Content	15.3 ±0.34	2.2 ±0.34
Crude Fibre	3.4 ±0.26	12.2 ±0.28
CHO (By Difference)	57.5	66.8
Calorie Value	412.4	295.8

Table 2: Elemental Composition of Synthesized Food Spice

Mineral (Ppm)	Synthesized Spice	Commercial Spice
Ca	64.3	28.6
Na	15.13	34.6
K	319.2	84.9
Zn	64.3	36.8
Pb	0.02	0.6
Mg	157.2	122
Fe	3.02	1.08
P	135.3	129
Cu	ND	0.23
Mn	ND	ND

Table 3: Some Functional Properties of Synthesized Food Spice

Parameter	Synthesized Spice	Commercial Spice
pH	6.19 ± 0.66	7.4 ±0.75
TTA (%)	1.15 ± 0.86	2.2 ± 0.78
Solubility (%)	6.48 ± 0.52	4.2 ±0.68
Swelling Power (g/g)	14.96 ± 0.88	8.5 ±0.76
WAC (mL/g)	3.17 ±0.45	1.8 ±0.48
Bulk Density (g/mL)	0.74 ±0.48	1.4 ±0.64

Table 4: Some Anti-nutritional Factors in Synthesized Food Spice

Phytochemical Compound	Synthesized Spice	Commercial Spice
Tannins (mg/100g)	0.51 ±0.84	2.5 ±0.66
Alkanoids (%)	1.15 ±0.66	3.4 ±0.78
Oxalates (mg/100g)	1.2	2.6
Flavonoids (%)	0.33 ±0.46	0.8 ±0.59
Saponins (%)	1.47 ±0.64	0.2 ±0.48
Phytin (%)	0.71 ±0.72	0.78 ±0.68
Total Terpernoid	0.2 ±0.48	1.3 ±0.62

Table 5: Sensory Evaluation of Synthesized Food Spice

Sample	Colour	Taste	Aroma	Overall Acceptability	Std. Dev
A1	7	6	6	7	±0.58
A2	6	5	6	6	±0.5
B1	8	9	8	8	±0.5
B2	9	7	8	8	±0.82

Key: A1: Meat soup cooked with pepper soup spice bought from local market

A2: Fish soup cooked with pepper soup spice bought from local market

B1: Meat soup cooked with processed food spice

B2: Fish soup cooked with processed food spice

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