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Micronutrient and Phytochemical Composition of Jansa (*Cussonia bateri)* Seed, A Lesser Known and Underutilized Spice in South Eastern Region of Nigeria

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Abstract

The objective of this study was to evaluate micronutrient and phytochemical compositions of jansa (*Cussonia bateri*) seed, an under-utilized spice in South Eastern Region of Nigeria. Specifically, the study determined mineral composition of the *Cussonia bateri* seed, vitamin contents of the *Cussonia bateri* seed, and phytochemical contents of *Cussonia bateri* seed. The seeds of *Cussonia bateri* were procured from Orie Ugba Market in Umuahia. The seeds were sorted, washed with water, oven dried using hot air oven at 55°C for 6 hours and milled into powder. The mineral, vitamin and phytochemical contents of the spice were determined using standard analytical methods. The data were analyzed and presented as means of triplicate analyses. Results showed that the spice contained appreciable amounts of calcium (37.34mg/100g), iron (1.13mg/100g), phosphorus (47.72mg/100g), potassium (69.67mg/100g) and some B group vitamins (2.69mg/100g thiamin, 0.90mg/100g riboflavin, 0.70mg/100g niacin and 0.64mg/100g pyridoxine). It also contained 3.07mg/100g flavonoids and 2.29mg/100g polyphenols. The micronutrient and phytochemical compositions of the spice were comparable to those of many other well-known indigenous spices, and incorporating this spice in dietscan contribute significantly to nutrients intakes of people in South-Eastern Nigeria and beyond. Again, the phytochemicals (flavonoids and polyphenols) contained in the spice are antioxidants that prevent degenerative diseases; hence, creation of awareness of benefits its consumption in diet through nutrition education is recommended.

Keywords: *Cussonia bateri,* Jansa, Seed, Lesser-Known, Underutilized, Spice, Micronutrients, Phytochemicals

Introduction

One of the most challenging issues in the world today is how to provide sufficient food to more than seven billion people around the globe (Perez-Escamilla*et al*., 2017). Food security is a complex, multifaceted concept usually influenced by culture, environment and geographical location. The Food and Agriculture Organization of the United Nations gave a clear definition of food security at five different levels (individual, household, national, region and global), as when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for active and healthy life (Perez-Escamilla*et al*., 2017).

Underutilized crops are those plant species with their potentials, not fully exploited, to contribute to food security andwhose nutritional or dietetic utility has not been fully documented or understood (Agulanna, 2020). Underutilized crops provide valuable macronutrients such as carbohydrates, proteins, fats, and micronutrients such as vitamins and minerals, as well as bioactive non-nutrients that contribute to dietary health (Fanzo et al., 2013; Dulloo *et al.*, 2014). It is however, argued that the potential of most indigenous crops has not been fully exploited, hence their underutilization (Perez-Escamilla*et al*., 2017). Under-valued crops if well-harnessed, can play a great role in promoting food security not only in Africa but also globally (Agulanna, 2020).

Spices are dried components of plants obtained from the seeds, fruits, roots, bark or other non-leafy part which are used for their aromatic and flavorful qualities in food preparation and manufacturing, therapeutic qualities and other beneficial qualities. Spices have been an integral part of culinary culture around the world and have a long history of use for flavouring, colouring, aroma, and as enhancing agents and for preservation of foods (El-Sayed and Youssef, 2019). Spices are popular among Nigerians, although most of the Nigerian spices are grown in the wild (Olife *et al*., 2013).

The immense food applications of spices has resulted in overdependence on convectional spices resulting to underutilization of some novel indigenous spices. However, the possible health risks associated with the consumption of synthetic antioxidants has led to an increasing necessity for utilization and consumption of natural spices not only because of their safety, but also as a result of increased consumer interest and knowledge of health benefits of natural foods. In Nigeria, over dependence on a few available spice remains a major challenge.

Cussonia bateri (C. bateri) is an underutilized crop and its seeds are known in Nigeria as*ugbaokwe* in Igbo,*sigo* in yoruba, *takandagiwa* in hausa, while the seeds are called jansa seeds in Cameroun, *bolo koro* in Senegal and *kokobidua* in Ghana (Nwokonkwo, 2013). *C. bateri* is common in Northern Nigeria; it is a small twisted savanna tree with thick corky bark. The leaves are oborate with lateral nerves; the flowers are greenish-white, with whitish fruits. In some places such as in Northern Nigeria, the seed of *C. bateri* is used in soup and has a pleasant aroma and sweet taste (Nwokonkwo *et al*., 2016).

The phytochemical results on the seeds of *C. bateri* revealed the presence of alkaloid, flavonoid, tannin, saponin, glycoside and phenol which indicated that the seeds could be useful medicinally (Nwokonkwo, 2013). Igbe *et al*. (2018) also reported that *C. bateri* are rich in phytochemicals such as rich in saponins, flavonoids, phenols, and alkaloids. Extracts and components isolated from the plant have demonstrated neuropharmacological, anti-larvicidal, anti-microbial, anti-inflammatory and antioxidant activities. Ethno-medicinally, *C. bateri* is used in Africa as an analgesic, anti-malarial, anti-inflammatory, anti-anaemic, anti-diarhoea, anti-poison, anti-pyschotic and anti-epileptic agent (Igbe *et al*., 2018).

Despite the health benefits and potential food applications of *C. bateri*, the crop is underutilized (Nwokonkwo *et al*., 2016). There is also dearth of information in literature on the nutrient composition of *C. bateri* despite its health benefits and potential food applications. Its evaluation will therefore, go a long way to promote its utilization in food preparation not only in South Eastern Nigeria but worldwide.

Objectives of the Study

The general objective of this study was to evaluate the micronutrient and phytochemical compositions of *Cussonia bateri,* (jansa) seedan under-utilized spice in South Eastern Region of Nigeria.Specifically, the study determined:

1. mineral composition of *Cussonia bateri* seed
2. vitamin composition of *Cussonia bateri* seed
3. phytochemical composition of *Cussonia bateri* seed.

Materials and methods

***Research design*:** Experimental design was adopted for this study.

***Procurement of materials*:** Wholesome seeds of *Cussonia barteri* were procured from Orie Ugba market, Umuahia, whereas reagents that were used for analyses were obtained from the Biochemistry Laboratory, National Root Crops Research Institute, Umudike, Abia State.

***Sample preparation*:** The method described by Nkwocha et al. (2019) was used in processing *C. barteri* spice. Fresh matured seeds of *Cussonia barteri* (500 g) were sorted, washed with water, oven-dried at 55°C for 6 hours and milled into fine powder using hammer mill and packaged in a polythene pack.

***Micronutrient (mineral and vitamin) determination*:** The calcium, magnesium, potassium, iron, zinc and sodium contents of the spice were determined by flame atomic absorption spectrometric method according to methods ofAOAC (2010). Jaway digital flame photometry was setup according to the manufacture's instruction. Phosphorus content was determined according to the method described by Onwuka (2018) using hydroquinone as a reducing agent. The methods described by Onwuka (2018) were employed in the determination of vitamin contents of the spice.All the determinations were done in triplicates.

***Phytochemical determination*:** Total polyphenols was determined using Folin and Ciocalteu's method as described by Onwuka (2018). Total flavonoids (TF) content of the spice was determined using the modified method of Onwuka (2018). The AOAC (2010) spectrophotometric method was used for the determination of phytate and tannin contents of the spice. All the determinations were done in triplicates.

***Data analysis techniques*:** Data were analyzed using means and standard deviations of triplicate determinations.

Results

Mineral contents of jansa seeds spice

Table 1: Mineral Contents (mg/100g) of Jansa Seeds Spice

Sample	Calcium	Magnesiu	Phosphorus	Potassium	Iron	Zinc
Jansa seed spice	37.34±0.06	22.89±0.07	47.72±0.08	69.67±0.08	1.13±0.04	0.84±0.04

Values are means ± standard deviation of triplicate determinations

Table 1 shows the mineral contents of jansa seeds spice. The calcium content of the jansa seeds spice was 37.34 mg/100g, its magnesium content 22.89 mg/100g, and phosphorus 47.72 mg/100g. The potassium content was 69.67 mg/100g, the zinc content 0.84 mg/100g, and the iron content 1.13 mg/100g. The Table also shows that the zinc content of the jansa seeds spice was 0.84 mg/100g, and its sodium content 34.70 mg/100g.

Vitamin contents of jansa seeds spice

Table 2: Vitamin Contents (mg/100g) of Jansa Seeds Spice

Sample	Thiamin	Riboflavin	Niacin	Pyridoxine	Ascorbic acid
Jansa seed spice	2.69±0.04	0.90±0.05	0.70±0.07	0.64±0.04	4.93±0.04

Values are means ± standard deviations of triplicate determinations

Table 2 shows the vitamin contents of jansa seeds spice. The Table shows that the seed had lowest content of pyridoxine (0.64 mg/100g) and highest content of ascorbic acid (4.93 mg/100g).

Phytochemical Properties of Jansa Seeds Spice

Table 3: Phytochemical Properties of Jansa Seeds Spice

Sample	Tannin (mg/100g)	Flavonoid (mg/100g)	Polyphenol (mg/100g)	Phytate (mg/100g)
Jansa seed spice	6.45±0.06	3.07±0.07	2.29±0.05	0.82±0.05

Values are means ± standard deviation of triplicate determinations

Table 3 shows the phytochemical properties of jansa seeds spice. The Table shows that the spice contained 6.45mg/100g of tannin, 3.07mg/100g of flavonoid, 2.29mg/100g polyphenol and 0.82mg/100g of phytate.

Discussion

The calcium content of the jansa seeds spice (37.34 mg/100g) was lower than 187.33 mg/100g found in aidan fruit spice (Nzebo *et al.*, 2019), and 64.80 mg/100g) reported for scent leaf spice (Paul *et al.*, 2018). The presence of calcium in the jansa seeds spice is of great benefit since its intake aids in preventing osteoporosis and colorectal adenomas, reducing hypertensive disorders of pregnancy, lowering of blood pressure especially among youths, lowering of cholesterol levels (Cormick and Belizan, 2019).

The magnesium content of the jansa seeds spice (22.89 mg/100g) was lower than 35.54 - 85.66 mg/100g reported for some commonly used spices in the

South-eastern part of Nigeria (Okonkwo and Ogu, 2014). The presence of magnesium in jansa seeds spice is of nutritional importance since magnesium is a vital element required as a cofactor for numerous enzymatic reactions and is thus, essential for several metabolic processes (Gerry and Stephen, 2017).

The phosphorus content of the jansa seeds spice (47.72 mg/100g) was higher than 0.80 - 1.62 mg/100g in ginger, black pepper, African nutmeganduziza seed (Okonkwo and Ogu, 2014). The presence of phosphorus in the jansa seeds spice will be of nutritional benefits considering that phosphorus plays a vital role in human body by activating enzymes catalysis, functioning in critical manner to produce and store calorie in phosphate bonds, and regulating gene transcription (O'Brien *et al*., 2012).

The potassium content of the jansa seeds spice (69.67 mg/100g) was higher than 6.93 - 8.67 mg/100g reported for six genotypes of aidan spice from Nigeria (Chinatu *et al*., 2017). The presence of potassium in the jansa seeds spice will contribute in playing a vital role in maintenance of cell function, lowering the risk of hypertension which cause development of stroke, coronary heart disease, heart failure, and end-stage renal disease and in reduction of risk of diabetes (Stone *et al*., 2016).

The iron content of the jansa seeds spice (1.13 mg/100g) was lower than 2.52 - 3.76 mg/100g reported for some commonspices in the South-eastern part of Nigeria (Okonkwo and Ogu, 2014). Presence of iron in jansa seeds spice will contribute in playing an imperative role in signaling of neuron, as it is needed for myelination of spinal cord and white matter of central nervous system in brain (Soetan *et al*., 2010).

The zinc content of the jansa seeds spice (0.84 mg/100g) was higher than 0.39 mg/100g was reported in *uziza* leaf (Ojinnaka *et al*., 2016), but lower than 135.91 mg/100g reported for African nutmeg spice (Onimawo *et al*., 2019). The presence of zinc in the jansa seeds spice suggests that its consumption will contribute in playing a vital role in human teeth, bones, muscles, nerves and brain function as well in enhancement of growth (Devi *et al*., 2014).

The thiamin content of jansa seeds spice (2.69 mg/100g) was higher than 0.13 mg/100g obtained in Ethiopian pepper (Bolu and Balogun, 2015), and was within the range (1.23 to 6.97 mg/100g) found in selected Nigerian spices (Ameh *et al*., 2016). Presence of thiaminin the jansa seeds spice spice implied that its consumption will contribute in playing a principal role in so many metabolic reactions that occurs in the human body especially, in metabolism of carbohydrate and protein required for energy generation, and functioning of the heart, nervous system and muscles (Chaitanya *et al*., 2012).

The riboflavin content of the jansa seeds spice (0.90 mg/100g) was higher than 0.21 mg/100g reported as riboflavin content of Ethiopian pepper (Bolu and Balogun, 2015), and 0.05 to 0.44 mg/100g reported for selected Nigerian spices (Ameh *et al*., 2016). The higher riboflavin content obtained in the jansa seeds spice suggests that its intake will contribute to preventing a wide array of diseases such as hyperglycemia, hypertension, migraine, cancer, diabetes mellitus and oxidative stress (Kiran *et al*., 2016).

The niacin content of jansa seeds spice (0.70 mg/100g) was higher than 0.07 mg/100g found in *uziza* leaf spice (Ojinnaka *et al*., 2016). Presence of niacin in food products is vital as it plays a role in metabolic processes which help the body utilize sugars, proteins, and fatty acids to create energy (Wardlaw and Smith, 2011).

The pyridoxine content of the jansa seeds spice (0.64 mg/100g) was lower than 1.34 to 2.20 mg/100g reported for five local spices used in Nigeria (Okorafor *et al*., 2019). However, the presence of pyridoxine in the jansa seeds spice indicated that its consumption will contribute in playing important role in the body as it is needed to maintain the health of nerves, skin and red blood cells (Wardlaw and Smith, 2011).

The jansa seeds spice had ascorbic acid content of 4.93 mg/100g which was within the ascorbic acid content range (1.32 to 4.97 mg/100g) of *Piper guineense, Xylopia aethiopica, Ocimum gratisimum, Ricinus communis*,and *Pergularia daemia* commonly consumed in Nigeria (Dodo *et al*., 2020). Consumption of jansa seeds spice will contribute in maintenance of healthy gums, bone formation, wound healing, and in protection of the body from damage of free radicals.

The flavonoids of the jansa seeds spice (3.07 mg/100g) was lower than values reported in aqueous extracts of ginger (5.10 mg/100g), bird pepper (6.21 mg/100g) and nutmeg [4.18 mg/100g] (Akeem *et al*., 2016). However, the presence of flavonoids in the jansa seeds spice is of immense benefit considering that flavonoids have antioxidant, antifungal and antibacterial properties.

The polyphenol content of the jansa seeds spice (2.29 mg/100g) was higher than polyphenol content of *Zingiber officinale* spice (0.10 mg/100g) and *Allium sativa* spice [0.00 mg/100g] (Ali *et al*., 2018]). The higher the polyphenol content of a food material, the higher its tendency to aid in antioxidant and antimicrobial activities which exert preventive activity against inflammation and allergies via antioxidant, antimicrobial and proteins /enzymes neutralization/modulation mechanisms, and against degenerative diseases (Ozcan *et al*., 2014).

The phytate content of the jansa seeds spice (0.82 mg/100g) was lower than 10 - 60 mg/100 g which can decrease bioavailability of minerals and is also detrimental to human health (Elinge *et al*., 2012). There is evidence that dietary phytate at low levels may have beneficial role as an antioxidant and anticarcinogens and play an important role in controlling hypercholesterolemia and atherosclerosis (Phillippy *et al*., 2004).

Conclusion

This study revealed that jansa seeds, an indigenous lesser known or underutilized spice are a potential source of micronutrients such as calcium, magnesium, phosphorus, potassium, iron and zinc needed for bone health, body development and metabolism. The mineral, vitamin and phytochemical properties of jansa seeds spice compared favourably with other indigenous and well known spices. The phytochemical compounds present in the spice such as flavonoids and polyphenol make it beneficial for prevention and control of chronic degenerative diseases such as cancer when incorporated into regular foods. The phytate and tannin contents of the jansa seeds spice are low; hence, will not pose any health hazard or decreases bioavailability of minerals, but will be beneficial to health. Incorporatingthis spice in one's daily diet is thus, vital for optimal health, and for protection from harmful effects ofenvironmental pollutants and contaminants in foods.

Recommendations

Based on the findings of this study, the following recommendations are made:

1. Incorporation of this spice as integral part of healthy nutritious diets to reduce incidence of non-communicable diseases.
2. Nutrition education of the public on the benefits of consumption of Jansa seed spice is recommended.
3. Further studies should be carried out on Jansa seed spice to confirm its therapeutic benefits.

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