Chemical Compositions of *Cussonia bateri* (Jansa Seed) - An Underutilized Spice in Nigeria

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ABSTRACT

Background: *The potentials of most indigenous crops have not been fully exploited. The underutilized crops, if well-harnessed, can play a great role in promoting food security both in Africa and globally.*

Objective: Chemical (nutrient and antinutrient) compositions of Cussonia bateri - an underutilized spice in Nigeria was evaluated.

Methods: *The jansa seeds were procured from Orie Ugba Market in Umuahia. The seeds were sorted, washed with water, oven dried using hot air oven at 55oC for 6 hours and milled into fine powder. The proximate, vitamin, mineral and antinutrient contents of the spice were determined using standard analytical methods. The data generated were statistically analyzed, and presented as means of triplicate analyses.*

Results: *The results showed that the spice was high in fat (25.71%), carbohydrate (51.23%), crude fibre (3.42%), thiamin (2.69mg/100g) and riboflavin (0.90mg/100g). The spice also contained appreciable amounts of crude protein (9.18%), pyridoxine (0.64mg/100g), magnesium (22.89mg/100g), phosphorus (47.72mg/100g) and potassium (69.67mg/100g). The spice contained 6.45mg/100g of tannin and 0.82mg/100g of phytate.*

Conclusion: *The nutrient compositions of jansa seeds spice were comparable to those of many other well-known indigenous spices; hence, incorporating this spice in diets can contribute significantly to people's nutrient intakes. The phytate and tannin contents of the spice were low; thus, will not pose health hazard or decrease bioavailability of minerals, but will be beneficial to health. Creation of awareness of benefits of this spice in food preparation is recommended.*

Keywords: Jansa, spice, underutilized, chemical composition

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INTRODUCTION

Underutilized crops are those plant species whose potentials are not fully exploited to contribute to food security, and whose nutritional or dietetic utility has not been fully documented or understood (1). Underutilized crops provide essential macronutrients and micronutrients, as well as, bioactive non-nutrients that contribute to dietary health (2,3). It has been however, observed that the potentials of most indigenous crops have not been fully exploited, hence their underutilization (4). Under-valued crops if well-harnessed, can play a great role in promoting food security both in Africa and globally (1).

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 flavourful qualities in food preparation and manufacturing, therapeutic qualities and other beneficial qualities. Although spices are low-cost commodities, they have been valued for many centuries, and have been an integral part of culinary culture around the world, being used for flavouring, colouring, aroma, and as enhancing agents and for preservation of foods (5).

The immense food applications of spices have resulted in overdependence on convectional spices resulting to underutilization of lesser-known indigenous spices. Again, the possible health risks associated with 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.

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 (6). The seed of C. bateri is used in soup and has a pleasant aroma and sweet taste (7). 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 (8). Despite the health benefits and potential food applications of C. bateri, the crop is underutilized (7), and there is dearth of information in literature on its nutrient and antinutrient composition; hence, their determination will go a long way to promote its utilization in food preparation not only in Nigeria but also globally.

MATERIALS AND METHODS

Study design

Experimental design was used 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.

Plate 1: Jansa Seeds

Sample preparation

The method described by Nkwocha et al. (9) was used in processing C. barteri spice.

Fresh *Cussona bateri* seeds
↓
Sorting
↓
Washing (with tap water)
↓
Drying (in oven at 55ºC for 6 hours)
↓
Milling with hammer mill
↓
Cussona bateri spice
↓
Packaging

Source: Nkwocha et al. (2018)

Figure 1: Flow chart for processing of C. barteri spice

Chemical Analysis of the Sample

The proximate, vitamin, mineral and antinutrient contents of the sample were determined in triplicates following standard analytical methods.

Proximate Snalysis of the Sample

The proximate compositions of the spice were analyzed using official methods of Association of Analytical Chemists [AOAC] (10). Moisture content was determined by hot air oven method (10). Ash content was determined by charring 2g of the sample in a preheated cooled crucible and incinerating it at 600°C for 6h in ash muffle furnace to obtain the ash. Crude fibre was determined by exhaustive extraction of soluble substances in the samples using H_2SO_4 and NaOH, after which the residue was ashed and the losses in weight recorded as crude fibre. The crude protein content was determined using micro-Kjeldahl method, while fat content was determined using Soxhlet extraction. Total carbohydrate content of the spice was determined by difference (10).

Vitamin Determination

The spectrophotometric method described by Onwuka (11) was employed in the determination of thiamin, riboflavin, niacin, pyridoxine and ascorbic contents of the spice.

Mineral Determination

Calcium, magnesium, potassium, iron, zinc and sodium determinations were carried out by AOAC methods (10). The calcium, magnesium, potassium, iron, zinc and sodium contents of the spice were determined by flame atomic absorption spectrometric method. Jaway digital flame photometry was set up according to the manufacture's instruction. Phosphorus content was determined according to the method described by Onwuka (11) using hydroquinone as a reducing agent.

Antinutrient Content Determination

The antinutrients (phytate and tannin) contents of the spice were determined by AOAC spectrophotometric method (10).

Statistical Analysis

Data obtained were analyzed using computer software Statistical Product for Service Solution version 23.0. Results were presented as means and standard deviations of triplicate determinations.

RESULTS

Proximate Composition of Jansa Seeds Spice

The proximate compositions of jansa seeds spice are presented in Table 1. The table showed that moisture content of the spice was 6.70%; crude protein was 9.18%, and fat content was 25.71%. It also showed that crude fibre, ash and carbohydrate contents of the spice were 3.42%, 3.72%, 51.23%, respectively.

Vitamin contents of Jansa Seeds Spice

Table 2 presents the vitamin contents of jansa seeds spice. It showed that the thiamin and riboflavin contents of jansa seeds spice were high (2.69 mg/100g and 0.9 mg/100g, respectively).

Table 1: Proximate Composition of Jansa Seeds Spice

Sample	Moisture content (%)	Crude Protein (%)	Fat (%)	Crude fibre (%)	Ash (%)	Carbohydrate (%)
Jansa seed spice	6.70±0.04	9.18±0.03	25.71±0.2	3.42±03	3.72±0.05	51.27±0.14

Values are means ± standard deviation of triplicate determinations

TABLE 2: Vitamin Content of Jansa Seeds Spice

Sample	Thiamin (mg/100g)	Riboflavin (mg/100g)	Niacin (mg/100g)	Pyridoxine (mg/100g)	Ascorbic acid (mg/100g)
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 3: Mineral Content of Jansa Seeds Spice

Sample	Calcium (mg/100g)	Magnesium (mg/100g)	Phosphorus (mg/100g)	Potassium (mg/100g)	Sodium (mg/100g)	Iron (mg/100g)	Zinc (mg/100g)
Jansa seed spice	37.34±0.06	22.89±0.07	47.72±0.08	69.67±0.08	34.70±0.09	1.13±0.04	0.84±0.04

Values are means ± standard deviation of triplicate determinations

TABLE 4: Antinutrient contents of Jansa Seeds Spice

Sample	Tannin (mg/100g)	Phytate (mg/100g)
Jansa seed spice	6.45±0.06	0.82±0.05

Values are means ± standard deviation of triplicate determinations

Mineral Contents of Jansa Seeds Spice

The mineral contents of jansa seeds spice are presented in Table 3. The calcium content of the jansa seeds spice was 37.34 mg/100g; its magnesium content was 22.89 mg/100g, and phosphorus was 47.72 mg/100g. The potassium, iron and zinc contents were 69.67 mg/100g, 1.13 mg/100g and 0.84 mg/100g, respectively.

Antinutrient Contents of Jansa Seeds Spice

Table 4 presents in the phytate and tannin contents of jansa seeds spice. It showed that the spice contained 6.45mg/100g of tannin and 0.82mg/100g of phytate.

DISCUSSION

Proximate composition of the Jansa Seed

The moisture content (6.70%) of the spice was lower than 21.67-84.67% reported for six spices (Gongronema latifolium - utazi, Piper guineense - West African pepper [uziza], Xylopia aethiopica - Guinea pepper, Monodora myristica - African nutmeg, Allium sativum - garlic, and Tetrapleura tetrapetra - uhio) commonly consumed in South Eastern Nigeria (12), and values (59.90% and 75.20%, respectively) reported for ginger and garlic spice (13). Moisture content of any food is an index of its water activity, and is basically used as a measure of food's stability and susceptibility to microbial contamination (14). Food products with moisture content above 14 % are not often stable at room temperature as it facilitates growth of microorganisms, thus, producing odours and undesirable flavours (15). The low moisture content obtained in the jansa seeds spice implied that it is less prone to spoilage and can be stored at room temperature.

The crude protein content (9.18%) of the jansa seeds spice was within 5.86-14.30% reported as the crude protein content of some selected spices (Myristica frangrans, Piper guineense, Monodora myristica and Rosmarinus officinalis) commonly used in the South-Eastern part of Nigeria (16), and also within 0.5-11.70% reported for selected spices (alligator pepper, aridan, and black pepper) in Southern Nigeria (17). However, the value of crude protein obtained in this study was lower than 18.47% reported for uda spice (18). The lower crude protein value recorded in this study is not of concern considering that spices are not basically consumed for their protein content but for their ability to enhance the organoleptic properties of foods, particularly flavour, and to some extent, intakes of minerals and vitamins; thus, playing complementary role in meals they are incorporated into.

The fat content (25.71%) of the jansa seeds spice was higher than 2.34-24.20% reported as fat content of five local spices used in Nigeria (Denniettiatripetala, Monodora myristica, Piper guineense, Syzygium aromaticum, and Xylopia aethiopica) (19), and 6.85% reported as fat content of turmeric spice (20), and 6.73% in negro pepper spice (18). The presence of high fat content in food products means high caloric value and it also serves as a lubricating agent that improves quality of products with regard to flavour and texture (21). In addition, fat is a carrier of fat-soluble vitamins: A, D, E and K (21).

The crude fibre content (3.42%) of the jansa seeds spice was lower than 5.98% and 6.11% reported for African pepper seeds and African pepper leaves, respectively (18), and the range of 8.79-14.26% obtained in Myristica frangrans, Piper guineense, Monodora myristica, and Rosmarinus officinalis (11). For a food product to be labeled as "good source of fibre", it must contain more than 3 g of dietary fibre/100 g (22). This implies that the jansa seeds spice is a good source of crude fibre; hence, its consumption will help in weight management and prevention of coronary heart disease and colorectal cancer (23). Again, the crude fibre contents of the spice was within the recommended range for diets (not more than 5 g per 100g dry matter) (24).

The ash content of the jansa seeds spices (3.72%) was higher than 5.38% obtained in Tetrapleura tetraptera fruit pulp consumed as spice in South-eastern Côte d'Ivoire (25). The ash content was within the range (2.41-5.56%) reported for five local spices (19). The ash content of food reflects the amount of nutritionally important minerals present in it (25). This suggests that consumption of the jansa seeds spice will contribute in providing vital minerals needed for development of human body (25), bone health and body metabolism (26). It has been shown that foods possessing ash content of 3 % and above is ideal for human consumption (27).

The carbohydrate content of the jansa seeds spice (51.23%) was lower than 70.51% obtained in uziza seeds spice (28), 67.38% obtained in turmeric spice (20), but higher than the carbohydrate content (26.08%) of negro pepper spice (18). The moderate carbohydrate content of the jansa seed spice implied that it will be suitable for diabetic patients.

Vitamin Content of Jansa Seeds Spice

The thiamin content of jansa seeds spice (2.69 mg/100g) was higher than 0.13 mg/100g obtained for Ethiopian pepper commonly utilized as spice (29), and was within the range of 1.23-6.97 mg/100g reported as thiamin contents of selected Nigerian spices (Zingiber officinale, Piper nigrum, Monodora myristica, and Piper guineense) (30). Presence of thiamin in the jansa seeds 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 (31).

The riboflavin content of the jansa seeds spice (0.90 mg/100g) was higher than 0.21 mg/100g reported for Ethiopian pepper (29), 0.05-0.44 mg/100g reported for selected Nigerian spices (30), and the values (0.06-0.08 mg/100g) obtained in Spondiasmombin, Dialium guineense, and Mordii whytii (32). 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 (33).

The niacin content of the jansa seeds spice (0.70 mg/100g) was higher than 0.07 mg/100g found in uziza leaf spice (28). Presence of niacin in food products is vital as it plays a role in different metabolic processes which help the body utilize sugars, proteins, and fatty acids to produce energy (34).

The pyridoxine content of the jansa seeds spice (0.64 mg/100g) was lower than 1.34-2.20 mg/100g reported for five local spices used in Nigeria (19), 3.85 mg/100g in turmeric spice (20), and (3.73 mg/100g) in negro pepper spice (18). 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 (33).

The jansa seeds spice had ascorbic acid content of 4.93 mg/100g which was within the range (1.32-4.97 mg/100g) found in Piper guineense, Xylopia aethiopica, Ocimum gratisimum, Ricinus communis,and Pergularia daemia commonly consumed in Nigeria (35). The consumption of the jansa seeds spice will contribute in maintenance of healthy gums, bone formation, wound healing, and in protection of the body from damage by free radicals.

Mineral Composition of the Jansa Seed

The calcium content of the jansa seeds spice (37.34 mg/100g) was lower than 187.33 mg/100g reported for aidan fruit spice (25), and 179.52-192.31 mg/100g reported for some selected spices (Myristica fragrans, Rosmarinus officinalis, Monodora myristica and Piper guineense) commonly used in the South-Eastern part of Nigeria (16). The presence of calcium in 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, and lowering of cholesterol levels (36).

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 (16), 300.00-465.00 mg/100g in Spondias mombin, Dialium guineense and Mordii whytii spices (32), and 80.92 mg/100g) in scent leaf (37). The presence of magnesium in the 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. It may be considered as a therapeutic intervention for so many challenges in human health such as renal calculi and cataract (38).

The phosphorus content of the jansa seeds spice (47.72 mg/100g) was higher than 0.80-1.62 mg/100g in Zingiber officinale, Piper nigrum, Monodora myristica and Piper guineense spice (30). 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, regulating gene transcription, buffering blood, and ensuring that signal transduction of regulatory pathways affecting a variety of organ functions ranging from renal excretion to immune response are enabled (39).

The potassium content of the jansa seeds spice (69.67 mg/100g) was lower than (122.07 mg/100g) in uziza seeds (28), and 217.70-274.62 mg/100g reported for some commonly used spices in the South Eastern part of Nigeria (16). It is however, higher than 6.93-8.67 mg/100g reported for six genotypes of aridan spice from Nigeria (40). 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, particularly in individuals on thiazide diuretic treatment (41).

The iron content of the jansa seeds spice (1.13 mg/100g) was lower than 2.52 - 3.76 mg/100g reported for some commonly used spices in the South-eastern part of Nigeria (16), 2.00-4.10 mg/100g obtained in Spondias mombin, Dialium guineense and Mordii whytii commonly consumed in South-west and Middle belt of Nigeria (32). However, presence of iron in jansa seeds spice will contribute in playing an imperative role in signaling of neurons, as it is needed for myelination of spinal cord and white matter of central nervous system in brain (42).

The zinc content of the jansa seeds spice (0.84 mg/100g) was higher than 0.23 mg/100g obtained in Tetrapleura tetraptera consumed as spice in South-eastern Cote d'Ivoire (25) and 0.39 mg/100g) reported for uziza leaf (28). It was however, lower than 135.91 mg/100g reported for African nutmeg spice (13). The presence of zinc in the jansa seeds spice suggests that its consumption will contribute in playing a vital role in growth, teeth, bones, muscles, nerves and brain functions (43).

The sodium content of the jansa seeds spice (34.70 mg/100g) was higher than 20.84 mg/100g obtained in uziza seeds spice (26), but lower than the sodium content (84.11 mg/100g) of scent leaf spice (44). Food or food products that contain 140 mg/100g of sodium or less are considered as low sodium foods (45). The low sodium of this jansa seeds spice will be of great importance as high sodium intake has been shown to contribute to hypertension in susceptible individuals, and leads to increased calcium loss in urine (22).

Antinutrient Contents of Jansa Seeds Spice

The tannin content of the jansa seeds spice (6.54 mg/100g) was higher than values found in ginger (3.42 mg/100g), red onion (6.81 mg/100g) and garlic [0.08 mg/100g] (46), and 4.10 mg/100g reported for Ocinum gratissinum spice (47). The presence of tannin content, which was within tolerable limit, in the jansa seeds spice is of great nutritional and health benefits since it has disease preventing and therapeutic actions such as superoxide anion scavenging, apoptosis, antitumor, anti-Epstein-Barr virus and anti-methicillin-resistant Staphylococcus aureus (48).

The phytate content of the jansa seeds spice (0.82 mg/100g) was lower than value reported for 1021.00–5170.00 mg/100g of Tetrapleura tetraptera spice (49). The low phytate content of the jansa seeds spice will not pose any health hazard when compared with the values of phytate (10-60 mg/100 g) which can decrease bioavailability of minerals and is also detrimental to human health (50). On the other hand, 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 (51).

CONCLUSION

This study revealed that jansa seed is a good source of crude fibre, fat, carbohydrate, thiamin and riboflavin, and contains appreciable amounts of crude protein and micronutrients especially, pyridoxine, magnesium, phosphorus and potassium which compared favourably with other well-known indigenous spices. 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. Incorporating this spice in one's daily diet is thus, vital for optimal health, and for protection from harmful effects of environmental pollutants and contaminants in foods.

RECOMMENDATIONS

Based on the findings of this study, sensory evaluation of dishes spiced with jansa seed is recommended to check its acceptability, after which, awareness of the benefits of its use in food preparation created through nutrition education, and people encouraged to incorporate the spice in their diets. Further studies should be carried out on jansa seed spice to confirm its therapeutic benefits.79

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