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Nutrient, Anti-Nutrients and Phytochemical Compositions of *Bosquiae angolensis* Fruits "oze" Consumed as Snacks in Enugu State, Nigeria

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Abstract: This study evaluated the nutrient, antinutrient and phytochemical compositions of lesser known *Bosquiae angolensis* "oze" consumed as snacks in Enugu State, Nigeria. The *B. eangolensis* fruits were obtained in the bush at Obinagu, Udi Local Government Area in Enugu state. They were sorted and washed with water, air dried and roasted in hot sand pan for 30 min on a gas cooker until soft texture was obtained and dehulled. They were grinded with electric grinding machine for chemical analysis. The analysis was carried out at the department of Home Science, Nutrition and Dietetics, University of Nigeria, Nsukka. Data was analyzed using SPSS version 17 to express means and standard deviations for three determinations. The results showed that *Bosquiae angolensis* contained 19.84% of protein, 0.81% fat, 10.30% fibre, 33.08% carbohydrate, 1.59 mg/100 g iron, 423.00 mg/100 g phosphorus and 17.74 mg/100 g zinc. It also contained 48.50 mg/100 g of carotenoids, 7.85 mg/100 g flavonoids, 1.66 mg/100 g alkaloids, 0.14 mg/100 g phytates and 1.72 mg/100 g tannins. *Bosquiae angolensis* demonstrated appreciable amount of good nutrient profile and its consumption should be encouraged among households especially for school children.

Key words: Nutrient, anti-nutrient, phytochemical, *Bosquiae angolensis*, Lesser-known seed

INTRODUCTION

Most reports on some lesser known and unconventional crops indicated that they could be good sources of nutrients and many of the crops have the potentials of broadening the present narrow food base for human (Elhassan and Yagi, 2010). In most developing countries, the food situation is worsening (Agwu *et al*., 2011; FAO, 2008, 1982).

Bosqueia angolensis (*B. angolensis*) referred to, as the "hospitality tree" in the cultural Igbo Community in Nigeria is a member of the botanical family, *Moracea*. It is a tropical rain forest tree and grows in the thick, humid forest of undisturbed land (Nwosu, 2011). The tree grows up to 30-40 m high as it competes with other hard wood for sunlight. Its green glossy leaves resemble those of 'Ogbono' (*Irvingia gabonensis*); but it is readily distinguished by the remarkably abundant latex flow observed immediately at a slash of its node. This fruit *B. angolensi* is called "Oze" in the Igbo speaking states of South Eastern state of Nigeria and is called "kokoeran" in the Yoruba speaking states of South Western states of Nigeria. In most developing tropical countries the food situation is worsening owing to the increasing population; shortage of fertile land, high prices of available staples and restrictions on the importation of food (Nwosu, 2010; Nwosu, 2011).

While every measure is being taken to boost food production by conventional agriculture, a lot of interest is currently being focused on the possibilities of exploiting the vast numbers of less familiar food plant resources existing in the wild (Elhassan and Yagi, 2010). Many such plants have been identified, but the lack of data on their chemical composition has limited the prospects for their broad utilization (Nwosu *et al*., 2012). Most reports on some lesser-known and unconventional crops indicate that they could be good sources of nutrients and many have the potentials of broadening the present narrow food base for human (Nwosu *et al*., 2008). The aroma of roasted *B. angolensis* seed is reminiscence (resembles) that of its family member, African breadfruit; but its usual traditional dehulling process is more laborious (drudgery) than that of African breadfruit seeds. This factor has limited the traditional processing of *B. angolensis* to mere hot-ash roasting and a limited consequent utilization as snacking kernels, just as roasted cashew nuts. Thus *B. angolensis* though aromatically and morphologically more like African breadfruit is utilized mainly as indigenous snacking nuts just like cashew nuts. Usually, the consumption of hot ash roasted *B. angolensis* seed results in high flatulence phenomenon, suggesting the presence of some anti-nutritional factors. Also the gas has a smell reminiscence of hydrogen sulphide suggesting the presence of sulfur containing amino acids which are among the essential amino acids needed in our daily diet. Application of different processing methods to *B. angolensis* seed will give some information, which may increase the utilization of *B. angolensis* seeds and

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enhance its potential in food formulations. It is envisaged that a more preferred process for the elimination or reduction of any detected anti-nutritional factor may be found for the production of safer *B. angolensis* product.

Objective of the study: The general objective of this study is to determine the nutritional values of *Bosquiae angolensis*, the anti-nutrients and the phytochemical component of this lesser known agricultural product consumed as snack in Obinagu, Udi Local Government Area Enugu State Nigeria.

Specific objectives: Specific objectives of the study are to:

1: Determine the nutritional components of *Bosquiae angolensis* fruit-seed
2: Find out the anti-nutrients in the fruit-seed
3: Evaluate the phytochemical component of *Bosquiae angolensis* fruit-seed

MATERIALS AND METHODS

Materials collection and preparation: The *B. angolensis* fruit-seeds were obtained in the bush at Obinagu, Udi Local Government Area in Enugu state, Nigeria. It was washed with water; air dried and roasted in hot sand for 30 min on a gas cooker until a soft texture was obtained and dehulled. The roasted dehulled fruit-seeds were milled in an electric blender to a flour consistency before subjecting it to chemical analysis. The analysis was carried out at the department of Home Science, Nutrition and Dietetics University of Nigeria, Nsukka food laboratory.

Laboratory analysis

Proximate determination

Determination of moisture: The standard method of Association of Official Analytical Chemists, (AOAC, 2005) hot air oven method was used.

Ash determination: The ash content of the sample was individually determined by using (AOAC, 2005) method.

Fat determination: The fat content of the sample was determined using Soxhlet extraction method described by AOAC (2005).

Protein determination: The protein content was determined using AOAC (2005) method.

Determination of fibre: The determination was done by using AOAC (2005) procedure.

Determination of carbohydrate: Carbohydrate content was obtained by difference. That is:

Carbohydrate (%) = 100-(Moisture+Protein+Fat+Ash+fibre %)

Mineral determination: Iron composition: The phenanthroline method described by AOAC (1990) was used to determine the level of iron in the samples.

Zinc composition: The dithizone method as described by AOAC (1990) was used to determine the level of zinc in the samples.

Phosphorus composition: It was determined using the vanado-molybdate colouritmetric method.

Potassium composition: It was determined using the flame photometry method.

Sodium composition: It was determined using the flame spectrophotometry method.

Magnesium determination: It was determined using the AOAC (1995) method.

Vitamins determination: Beta-carotene, Vitamin C and Vitamin E contents were determined using the method of chemical analysis of food described by AOAC (2000).

Phytochemicals: Steroid determination was done using Subhadhirasakul and Pechpongs (2005). Carotenoid, Flavonoids and Alkaloids were determined using Onyeka and Nwambekwe (2007), Saponin was determined using Obdoni and Ochuko (2001) methods.

Antinutrients: Tannin and Phytates were determined using AOAC (2000) methods and Latta and Eskin (1980) methods, respectively.

Data analysis: Data was analyzed using SPSS version 17 to express means and standard deviations for three determinations.

RESULTS AND DISCUSSION

The low moisture content of *Bosquiae angolensis* (27.32%) (Table 1) suggests that the levels of other nutrients might be high. This accounts for its high protein (19.84g), fibre (10.30%), ash (8.67%) and carbohydrate (33.08%). This confirms the report made by that the lower the moisture content of a given food, the higher the nutrient density. The protein content of *Bosquiae angolensis* is high when compared with African bread fruit *Artocarpus altilis* (0.8 g) in the same family (Osabor *et al*., 2009). Its protein content is high enough to meet the protein requirements of children at ages 1-3 whose daily protein requirement is 13 g/day. Among the proximate contents, fat remains the lowest and corresponds with the literature reports that fruits have lower fat content (Jaime, 2010).

The Vitamin A (402.83 IU), Vitamin C (31.27 mg/100 g) and Vitamin E (5.60 mg/100 g) contents of *Bosquiae*

angolensis (Table 2) is higher than that contained in African bread fruit *Artocarpus altilis* (Vitamin C 1.0 mg) and *Ficus carica* (Vitamin C 1.2 mg). And the levels of these Vitamins in *B. angolensis* are enough to meet the requirement need for children between ages 4-8 years, especially of vitamin A whose daily requirement is 400 IU. It will also furnish the vitamin C requirement of children ages 9-13 years whose daily requirement is 45 mg and the vitamin E requirement of children ages 1-3 years is 6 mg daily. Consumption of the fruit could provide a lot of health benefits. These vitamins are very powerful antioxidants. Antioxidants are known to protect the cells by reacting with oxidizing factors and neutralizing their effects (Hamid *et al*., 2010). They help protect the body from cell damage caused by free radicals and peroxides. Consumption of fruits with high Vitamin A, Vitamin E and Vitamin C levels could be effective in preventing cancer and other degenerative diseases. Vitamin A and Vitamin C enhances iron absorption and utilization. The enhancing effect of ascorbates has been attributed to its reducing and chelating properties during the digestion of food (Hurrel and Egli, 2007).

The presence of ascorbates in foods overcomes the negative effects of all major inhibitors of iron absorption including phytates and polyphenols that increase iron absorption two to three folds (Siegenberg *et al*., 1991). Ascorbate also enhances iron absorption by reducing the iron III ions to its ferrous (Fe^{2+}) state, a form in which iron is absorbed. Vitamin A improves the absorption of iron possibly by forming a complex with iron, keeping it soluble in intestinal lumen and preventing the inhibitory effects of phytates and polyphenols on iron absorption (He *et al*., 2007). Vitamin A helps to strengthen and boost immune system in fighting infection and also necessary for good eye health. It improves iron status possibly by reducing levels of infection, improving production and proliferation of red blood cells in bone marrow, increasing the absorption of Iron from food in the intestine and mobilization from body store (He *et al*., 2007). Inclusion of the fruits as a dietary component would improve absorption of iron from plant foods which is poorly absorbed. The level of Vitamin A and ascorbates in *B. angolensis* will synergistically facilitate the absorption of the significant quantity of Fe (1.59%) present in the fruits.

The level of potassium in the fruits (Table 3) with reference to the level in other fruits of the same family is similar. African Bread fruits (Artocarpus altilis) (400 mg) (Osabor *et al*., 2009), Fig Fruit (Ficus carica) (680 mg) (Kislev *et al*., 2006) and that of B. angolensis (682 mg) would further enhance the health benefits of the fruits. Potassium is essential for the normal functioning of the nerves, muscles and heart, sugar metabolism, acid-base balance and oxygen metabolism in the brain (Tolonen, 1990). Phosphorous levels of the fruits is appreciable (423 mg) like that of the family members *artocarpus artilis* (420 mg) and lesser in *Ficus* carica (67 mg) (Kislev *et al*., 2006). Consumption of this fruit could support good healthy bone.

The low levels of phytochemicals in the fruits (Table 4) are in line with literature documentation that phytochemicals occur in small quantities in plant foods (Boyer and Liu, 2004). The presence of flavonoids in the fruits is desirable. Flavonoids are large group of compounds widely distributed in plants food. They have anti oxidants properties to protect the body against cardiovascular diseases and some form of Cancer (Nielsen *et al*., 2013). Alkaloids, steroids and glycosides were present in the fruits (1.67, 0.26 and 0.07%, respectively). These phytochemicals are known to protect the body by decreasing the risk of heart disease, stroke and certain type of cancer (He *et al*., 2007). Saponins and phytosterols identified in the fruits have

Table 1: Proximate analysis of *Bosquiae angolensis* mg/100 g

Nutrients	Mg/100 g
Protein	19.84 ±0.04
Ash	8.67±0.04
Moisture	27.32±0.02
Fat	0.81±0.03
Fibre	10.30±0.07
Carbohydrate	33.08±0.05

Mean±SD of 3 determinations

Table 2: Vitamins content of *Bosquiae angolensis*

Nutrients	
Vitamin A (IU)	402.83±0.07
Vitamin C (mg/100 g)	31.27± 0.09
Vitamin E (mg/100 g)	5.60±0.07

Mean±SD of 3 determinations

Table 3: Mineral content of *Bosquiae angolensis* mg/100 g

Nutrients	Mg/100 g
Iron	1.59±0.03
Sodium	31.14±0.15
Potassium	682.00±3.0
Phosphorous	423.00±3.0
Magnesium	316±1.73
Zinc	17.74±0.5

Mean±SD of 3 determinations

Table 4: Phytochemical contents of *Bosquiae angolensis* mg/100 g

Nutrients	Results
Flavonoids	7.85±0.03
Carotenoids	48.50±2.50
Alkaloids	1.66±0.06
Steroids	0.31±0.26
Glycosides	0.07±0.01

Table 5: Anti-nutrient content of *Bosquia eangolensis* mg/100 g

Nutrients	Results
Phytates	0.14±0.01
Saponins	4.46±0.04
Tannins	1.72±0.03

the potential to lower cholesterol levels in the human body due to their hypocholesterolemic effect (Nielsen *et al*., 2013). Saponins form complexes with cholesterol to reduce plasma cholesterol levels. Saponins are also known to reduce the uptake of certain nutrients like glucose and cholesterol at the gut through intra-lumenal physiochemical interaction (Prince *et al*., 1987). Also, when saponins are consumed, they may aid in lessening the metabolic burden that would have been placed on the liver (Igboh *et al*., 2009). The saponins were also known to inhibit structure dependent biological activities (Ekeanyanwu *et al*., 2010). Phytosterols lower cholesterol level by blocking the uptake of cholesterol. The cholesterol is thus excreted from the body. This helps to prevent heart diseases. Phytosterols are plant counterparts of cholesterol and thus inhibit its absorption. Consumption of this fruit could help to prevent cancer, stroke and cardiovascular diseases because of their phytochemical constituents.

The tannins (Table 5) content of the fruit is (1.72 mg), the phytate content is (0.14 mg). According to WHO, phytate level in foods below 5 mg are safe for human consumption. Tannins affects the digestive tract and their metabolites are toxic (Ene-Obong, 1992). The precise toxic amount of tannins to cause depression in human is not yet known. The knowledge of phytates levels in food is necessary because high concentration of phytates can cause adverse effects on digestibility. Also, phytanic acids bind metal ions like calcium, zinc, iron and other minerals, thereby reducing their availability in the body (Adeduntan, 2014). They also inhibit digestion of protein by forming complexes with them (Singh and Krikoram, 1982). The high levels of anti nutrients in *B. angolensis* can be reduced by a number of processing methods like soaking, fermenting and boiling (Soetan and Oyewole, 2009).

Conclusion: *Bosquiae angolensis* contains appreciable quantities of nutrients with health promotion benefits. They include protein, carbohydrates, ash, fat and fibre. Also anti-oxidants which includes Vitamin A, Vitamin C and Vitamin E. Also there were appreciable amount of minerals like Potassium, phosphorous, magnesium, sodium, zinc and iron.

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