PROXIMATE COMPOSITION AND MICRONUTRIENT QUALITY OF COMMERCIAL "IGBA", "OSU AKIDI" AND "OKPA" (THREE LEGUME BASED FOOD PRODUCTS)

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Abstract

The proximate composition and some micronutrient quality of "Igba", "Osuakidi" and "Okpa" were studied. The moisture and ash contents of the samples were 42.32±035% and 3.02±0.02% for "Igba"; 34.72±0.46% and 9.59±0.37% for "Osuakidi" and 50.09±0.29 and 4.60±0.60% for "Okpa" respectively. Their crude protein contents were 19.09±0.63% for "Igba" 27.29±0.37% for "Osuakidi" and 19.32±0.32% for "Okpa" while their respective fat/lipid contents were 9.70±0.21%, 3.13±0.05%, and 10.56± 0.5% for "Igba" "Osuakidi" and "Okpa". Microelements like iron, magnesium and calcium were 1.47± 0.01ppm; 18.66±2.40ppm, and 2.73±4.96ppm for "Igba". "Osuakidi" had 19.66± 1.34ppm magnesium and 30.46±0.54ppm Calcium and these were significantly higher than the values from the other legume based food products studied. Enhanced consumption of these local foods/delicacies should be encouraged.

Keywords: *Traditional foods, "Igba", "Osu akidi", "Okpa", Proximate compositions, Micronutrient quality*

Introduction

Okeke *et al* (2008) reported of twenty (20) legumes in their Igbo Traditional Food System Documentation. African yam bean, *Krestingella geocarpa* and *Vigna subterranean* were listed.

The legume based local delicacies or foods produced from these legumes and native to south eastern Nigeria include "Igba" "Osuakidi" and “Okpa”. These ready to eat foods have continuously gained some degree of commercial significance, especially the “Okpa” food product. “Okpa” food product is a household name particularly in Enugu State and, its production has advanced so much to a level where the processors should form clusters, in readiness for industrialization.

This “Okpa” a gelled Nigerian Food Product is produced from the flours of Bambara Groundnut (BGN) seeds. This food product is very popular in the south eastern parts of Nigeria and has both penetrated and features either as a snack of main meal in most families’ weekly menu. This “ready to eat” food product is also sold in the markets, streets, institutions and at most motor parks from where travelers purchase and eat it hot and may carry some to serve as meals/snacks on their journeys. Onuorah (2011) reported of its presence in many parts of Nigeria including that it is marketed between the east and northern routes. It is rich in protein and has a good balance of amino acids (Barimalaa, 2000). It also possesses a relatively long resident time properties in the gastro-intestinal track (Onimawo *et al*, 2007).

Its production involves the mixing of measured ingredients namely Bambara groundnut flour, water, salt and palm oil (this being the traditional recipe), to produce a homogenous paste. The paste is then wrapped with wilted banana or plantain leaves, or cellophane paper or both. After tying with twine to prevent leakages, the wraps are dropped into boiling water and the materials are cooked for about 60mins or more. Traditionally the Okpa products are steamed for an average of about three hours often referred to as overnight cooking. The gelled Okpa Food Product is then cooled and eaten, and could also be taken for commerce.

Igba", is a type of moi-moi (i.e., steamed cowpea paste) produced from *Sphenostylis stenocarpa*, commonly known as African yam bean (AYB). Various Igbo communities know the raw African yam bean seeds as "Okpaodudu", Azam" or “Nzamiri”. Its other names include "Odudu", "Ijiriji", and, "Ofi" (Ogbo, 2002). Enwere (1998) also reported its other Nigerian names as “girigiri” (Hausa), “sese” (Yoruba) and “nsama” (Ibibio). This legume is produced and eaten in Imo, Anambra, Enugu, Cross River, Delta, Edo, Ondo and Oyo States. In the processing and production of "Igba" Food Product, or Igba uzuaki or Igho Igbagidi (as various communities in Enugu State call it), the *S. stenocarpa* seeds are first dry cleaned and given a flash ≤60mins soaking treatment, then roasted (by heating the seeds in empty but clean pans with continuous heating and stirring) until the seeds crack, after which air-cooling is done. Lastly, the roasted beans are milled (using either pestle and mortar, milling stones or with mechanical-millers). The flours are then measured out, and sufficiently

hydrated with water, then mixed with palm oil and salt. This mixture is then scouped and wrapped with natural leaves especially *Napoleona imperialis* leaves then tied with leafy part of palm fronds. With 90 to 120 minutes steaming, followed by cooling under atmospheric conditions, the traditional food, "Igba" is ready for consumption or sales.

"Osuakidi" is produced from *Krestingella geocarpa* seeds, commonly known as Krestling ground nuts (KGN), and, "akidi ala" (in Igbo). KGN seed is somewhat deep navy blue in colour with white eye in its raw state. This "Osu akidi" food product is popular in many places including Isuochi and Ezi-ama areas of Abia State and is produced by the process below. First is the dry cleaning stage involving winnowing and manual picking out of strings, pod particles, stones and other extraneous materials. Next is the over-night soaking in excess potable water followed by wet-milling, (using pestle and mortar or milling machine), to produce highly coarsely milled paste. After brief whisking, the thick and light purple coloured mixture is wrapped with wilted Plantain or Banana *(Musa paradisaca)* leaves, and then tied with leafy part of palm frond or stringy parts of Plantain or Banana plant. Whitish and strong twine are recently being used to tie the wrap. Heating and boiling for 60-90minutes produces cooked "Osuakidi". After cooling, the traditional food product can be eaten as such, but dipping it in salted palm oil, spiced with pepper or; palm oil sauce or stew, before consumption is often preferred. The palm oil sauce or stew may contain crayfish flour and "Ogiri", particularly for the palm oil sauce. These enhance the sensory and nutritional quality of the product. Sometimes, the consumers use the cooked "Osuakidi" to garnish "abacha" dishes. "Abacha" dishes are produce when rehydrated processed

edible cassava slices are mixed with, seasoned "ncha" (palm oil in water emulsion).

Cowpea *Vigna unguiculata,* is the most widely grown, distributed and consumed legume in Nigeria. It is the first in the legumes' list presented by Okeke *et al* (2008). It is an important food legume in both African and South East Asia (Sanni *et al,* 2006), but cowpea alone cannot solve the long term malnutrition problem of the poor nations (Nigeria inclusive), neither can food aid or trade solve it. Adequate utilization of indigenous plant foods can contribute towards the solution to malnutrition especially for the low income group. Traditional food, defined by Okeke *et al* (2008) as "all food from a particular culture available from local resources and culturally accepted" (Ihekoronye and Ngoddy, 1985) will go a long way towards addressing malnutrition issues. Besides, the literature is replete with the call for research on such leguminous food grains as African yam bean, *S. stenocarpa* (Hochst ex A. Rich), Bambara groundnut, *Vigna subterranean* (L).Verdc and *Krestingella geocarpa* (Bhat and Karim, 2009; Fasoyiro *et al,* 2012). Scarce information on the chemical quality "Igba", "Osuakidi" and "Okpa" informed this study.

Materials and Methods

(i) Sample collection: "Igba" and "Okpa" were purchased from hawkers in Enugu City while the "Osuakidi" wraps were purchased from "Orie" Isuochi markets in, Abia State

(ii) Proximate composition of samples.

The moisture, ash, lipid/fat, crude protein and crude fibre contents of the samples were determined by AOAC (2010) methods. Total carbohydrates were determined by difference, while the calorific value or energy value was calculated using the factor: 4.1 (for carbohydrate and protein); 9.4 for fat (Fox and Cameron, 1989). Atomic Absorption Spectrometry (AAS) was also conducted for the determination of the elemental composition of the ash, using APHA (1995) method.

Results and Discussion

The proximate composition results were recorded on Table 9.3.4.1, while the micronutrients' quality was recorded on Table 9.3.4.2. There were significant differences in the chemical quality of the legume based delicacies.

Table 9.3.4.1: Proximate Composition of the commercial "Igba", "Osu akidi" and "Okpa"

Parameters	**Igba**	**Osu akidi**	**Okpa**
%Moisture	$42.32^{b}\pm 0.35$	$34.72^{c}\pm 0.46$	$50.09^{a} \pm 0.29$
%Ash	$3.02^{c} \pm 0.02$	$9.59^{a}\pm 0.37$	$4.60^{b} \pm 0.60$
%Crude protein	$19.09^{b}\pm 0.63$	$27.29^{a}\pm 0.37$	$19.32^{b} \pm 0.32$
%Fat	$9.70^{b} \pm 0.21$	$3.13^{c}\pm 0.05$	$10.56^{a} \pm 0.56$
%Crude fibre	$3.11^{b} \pm 0.11$	$7.90^{a}\pm 0.08$	$2.87^{c} \pm 0.15$

Carbohydrate	$22.79^{a} \pm 0.79$	$17.39^{b} \pm 0.12$	$12.56^{c} \pm 0.64$
Energy KJ/100g	1104.14KJ/100g	888.76KJ/100g	965.87KJ/100g

Values are means ± Standard deviation of triplicate determinations. Means with the different letters along a row showed significant difference ($p < 0.05$).

Table 9.3.4.2: Micronutrient Composition of the samples

	Samples		
Microelement	**"Igba"**	**"Osu akidi"**	**"Okpa"**
Iron	$1.47^{b} \pm .010$	0.79c ±0.10	$1.75^{a} \pm 0.05$
Calcium	$12.73^{b} \pm 4.96$	$30.46^{a} \pm 0.54$	$14.04^{b} \pm 4.00$
Zinc	$3.62^{b} \pm 0.24$	$7.73^{a} \pm 0.31$	$2.18^{c} \pm 0.08$
Potassium	$7.63^{c} \pm 1.45$	$171.79^{b} \pm 0.70$	$191.08^{a} \pm 1.00$
Magnesium	$18.66^{a} \pm 2.40$	$19.66^{a} \pm 1.34$	$18.66^{a} \pm 0.26$
Sodium	$3.10^{a} \pm 0.10$	$0.00^{c} \pm 0.00$	$1.10^{b} \pm .11$
Copper	$0.14^{a} \pm 0.00$	$0.07^{b} \pm 0.01$	$0.04^{c} \pm 0.01$

Values are means ± Standard deviation of triplicate determinations. Means with the different letter along a row showed significant difference ($p < 0.05$).

Table 9.3.4.1 shows that the samples had a moisture content which ranged between 34.72 ± 0.6% (Osuakidi) and 50.09 ± 0.29% (Okpa). Onimawo *et al* (2007) reported 46.40% moisture for "Okpa" All were at intermediate moisture level according to the classification of Okaka and Okaka (2001). Direct added water or by diffusion during the preparation was minimal for

the "Osuakidi" and the "Igba" samples. This is a process requirement and, it is claimed that the "Osuakidi" product may be devoid of such noticeable changes like drawiness in the product by the third day of its production, without re-heating the product. Average ash content of 3.02 ± 0.02% for "Igba"; 4.60 ± 0.60% for "Okpa" and 9.59 ± 0.37% for "Osuakidi" were obtained. Onimawo *et al* (2007) reported 3.40% for stemed cake (Okpa) from bambara nut. "Osuakidi" was significantly higher ($P<0.05$) in ash compared to other samples. Detailed micro-elements obtained by Atomic Absorption Spectrophotometer (AAS) were presented in Table 9.3.4.2. Udensi (2005) reported that soaking before processing as in "Osuakidi" is an effective traditional method of improving the nutritional quality of different food crops. Tripsin inhibitor, tannin, phytic acid, hydrogen cyanide, heamaghitins, raffinose and stachyose were among the anti-nutritional factors reported to have been reduced within the 6-24 hours of soaking in 'akidiala' (*K. geocarpa*). Again, longer times enhanced greater removal of the anti-nutrients in that study.

Crude protein content of the samples ranged between 19.09 ± 0.63% ("Igba") to 27.29 ± 0.37% ("Osu akidi"). Ihekeronye and Ngoddy (1985) and Okaka, (1997) reported the normal range of proteins in leguminous seeds to be between 21.6% and 23.4%. However, Omoikhoje and Omueti (2000) reported 19.40% and 21.64% crude proteins respectively for cooked and roasted BGN flours. The fat and carbohydrate contents of the samples where 9.70±0.2% and 22.79±0.79% for "Igba", 3.13±0.03% and 17.39±0.12% for "Osu akidi" and 10.56 ± 0.56% and 12.56±0.64% for "Okpa", see Table 4.1. These values were significantly different from each other but compare favourbaly with some cowpea products. Sanni *et al* (2006) reported the ash of content seven to eight varieties of cowpea to be

1.6% to 4.1%. 4.60±0.60% ash was obtained from the "Okpa". Nzelu, (2014) obtained being 3.57±0.10% ash in the Okpa produced from white/cream coloured bambara groundnut seeds' flour, to which only common salt, palm oil and water were the additions. The respective crude fat and crude proteins for the products (in %) were 9.70±021, 19.09±0.09 for Igba; 3.13±0.05, 27.29±0.37 for "Osu akidi" and 10.56±0.56 and 19.32±0.32 for Okpa. Nzelu (2008) reported the fat content of roasted and dehulled *S. stenocarpa* beans as 2.50%. Also 7.34% and 2.24% crude fat have been reported earlier for flours of roasted BGN seeds by Omoikhoje and Omueti (2000) and Nzelu (2014) respectively. The addition of palm oil in the production of the "Igba" and "Okpa" as against "Osuakidi" must have enhanced the lipid contents of the two products. This could explain why "Osuakidi" had the least crude fat content.

"Osu akidi" was highest in its content of crude fibre (7.09 ± 0.08%) while "Igba" had 3.11 ± 0.1% and "Okpa" had 2.87 ± 0.15%. It is expected that the hulls of the seeds would have contributed to the crude fibre contents of these food products. The highest value of crude fibre was obtained from "Osuakidi" this could be because the seed hulls were not removed before the size reduction during the process to produce the very coarse mash/paste. Fibre is usually high in hulls. This indigestible component of plant materials provides roughage and bulk for controlling a healthy condition of the intestine (Potter and Hotchkiss, 1995).

There was a significant difference ($p<0.05$) in the level of carbohydrate among the legume based food products. "Igba" had a carbohydrate content of 22.79 ±0.79% as against the 17.39 ±0.12% of "Osuakidi" and 12.56

±0.64% for "Okpa". Onimawo *et al* (2007) reported of 11.38% carbohydrate from steamed cake (Okpa) made from bambara nut, and 12.51% carbohydrate from steamed cake (moin-moin) from cowpea. The energy values of "Igba", "Osuakidi" and "Okpa" in KJ/100g were 1104.14, 888.76 and 965.87 respectively. "Igba" and "Okpa" are known to demand water consumption from consumers. This development is a common after effect when leguminous seeds are consumed. Both "Okpa" and Cowpea's Glycemic effect was determined by Onimawo *et al* (2007) and Okpa was reported as having lower glycemic index than cowpea with average glycemic index values of 77.94 for moin-moin and 38.33 for Okpa. The ability of a food to cause a sharp increase in blood sugar is termed Glycemic effect. Thus, "Okpa" is a better diet for the diabetic patients. It is also a good food for farmers, especially during the mound making sessions during the farming seasons.

The micronutrient composition of the three legume food products were recorded on Table 2 (in ppm). These include Iron (Fe^{++}), Sodium (Na^{+}), Magnesium (Mg^{++}), Calcium (Ca^{++}), Potassium (K^{+}), Zinc (Zn^{++}) and Copper (Cu^{++}). Legumes are good sources of Iron (Fe^{++}). The Fe^{++} contents of the legume based foods varied significantly and ranged between 0.79±0.1ppm and 1.75±0.05ppm with "Okpa" having the highest quantity. Murano (2003), reported legumes among others as the chief sources of Fe^{++} with the chief role of Fe^{++} including Haemoglobin formation, energy utilization and, part of myoglobin with its deficiency symptoms including anemia, weakness, headaches and reduced immunity among others. Legumes are also listed among the chief sources of calcium (Murano 2003). Calcium is a principal mineral in bones and teeth. It is also involved in muscle contraction and relaxation as well as in nerve

function, blood clothing and blood pressure. Calcium contents of the legume samples were 30.46±0.54ppm for "Osuakidi", 14.04±4.00ppm for "Okpa" and 12.73±4.96ppm for "Igba". "Osuakidi" could therefore be described as a recommendable best source of Ca^{++} nutrient, when the three legume foods are considered. The Zinc (Zn^{++}) content of the legume based foods also differed significantly. The range was between 2.18±0.08 and 7.73±0.31, see Table 2. The Zn^{++} concentration in the products was highest in "Osuakidi" followed by the concentration in "Igba" and the least concentration was from "Okpa". Protein rich foods, such as meats, fish, and poultry among others are the best sources of Zn^{++}. Zinc functions as part of many enzymes. It is present in insulin and is involved in making genetic materials and protein. It is also involved in making sperm and in foetal development. The highest concentration of potassium was from "Okpa" which had 191.08±1.00 followed by the 171.79±0.70 obtained from "Osu akidi" and lastly, the 7.73±0.31, obtained from "Igba". All whole foods, meat, milk, fruits, vegetables, grains and legumes are good source of potassium (Murano, 2003). Potassium facilitates such reactions as protein synthesis, fluid balance, nerve transmission and contraction of muscle. It must be remembered that the land used for cultivation, age and the variety of crop and, environmental conditions usually bring about the differences in different crops' constitution. There was no significant difference in the concentrations of the Mg^{++} nutrient in terms of their concentrations. However the values obtained were between 18.66±2.40ppm and 19.66±1.34ppm. Magnesium plays such roles as bone mineralization, protein synthesis, enzyme action, normal muscular contraction and nerve transmission. Murano (2003), reported the major

sources of magnesium as nuts, legumes, whole grains and dark green vegetables among others. No common salt was added to "Osuakidi" during the production and it will not be surprising that "Osuakidi" had nil concentration of Sodium (Na^+) while "Igba" had the highest Na^+ concentration. Because the procedure of these products have not yet been standardized, personal idiosyncrasy of the individual processors would most likely interfere. Again, agronomical practices will also interfere as far as all constituents are concerned. Though the concentrations of the Copper (Cu^{++}) nutrient obtained differed significantly (see Table 2), Copper had the very least concentrations when considering all the values obtained for the nutrients quantitatively in the three legumes based food products. "Igba" had the highest value, 0.14±00ppm while "Okpa" had the least concentration with 0.04±01ppm. All the same, copper is very important being part of several enzymes and helps in making haemoglobin in the blood. Diarrhea, vomiting and nausea are some of the deficiency symptoms for lack of or insufficient copper concentrations in the body. "Osuakidi" had the highest concentrations of calcium, zinc and magnesium elements, while Okpa had the highest of iron and potassium contents. "Igba" had the highest concentration of sodium and least of potassium. Generally these legume food products are good sources of micro-elements and, consumption of these local delicacies are encouraged.

Conclusion

These traditional food products are good sources of proteins and ash and are rich in energy. While iron may be sourced from "Okpa", magnesium and calcium were highest in "Osu akidi". Enhanced production and consumption of these food products should be encouraged, while the

amino acid profiles should be determined for nutritional predictions. Efforts should also be made for as for improved packaging studies. All the three legume products were wrapped with natural leaves and in the traditional setting, spice (not even onions or crayfish) is not used.

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