Nutritional Composition of Three Selected Traditional Diets: A Case Study of Ngwa People in Abia State, Nigeria

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Abstract The consumption and encouragement of indigenous diets could help alleviate malnutrition and mitigate food insecurity in developing countries. In this regard, three Nigerian traditional diets: Akidi (*Vigna unguiculata*), Akara-Igboro (*manihot esculenta*), and Ofe-achara (*Pennisetum purpureum* soup) mixed with Mgbam (baked melon seed) and Garri (Cassava flakes) were evaluated for sensory characteristics, proximate composition, anti-nutrient composition, as well as vitamins, and mineral content using standard methods. Data from the sensory characteristics indicated that Ofeachara mixed with Mgbam and Garri (7.67 ± 0.89) was the most acceptable diet. The proximate analysis also revealed that Ofeachara mixed with Mgbam and Garri was highest in carbohydrate, ($55.08 \pm 4.66\%$), Ash ($6.67 \pm 2.89\%$) and moisture content ($8.41 \pm 0.89\%$) while Akidi was highest in protein ($5.91 \pm 0.05\%$) and crude fibre ($12.31 \pm 0.01\%$). The anti-nutritional analysis of the diets revealed that Akara-Igboro had the highest phytate ($0.40 \pm 0.01\%$), Alkaloid ($50.00 \pm 1.33\%$), oxalate ($27.28 \pm 0.88\%$) and Cyanogenic glycosides content ($1.62 \pm 0.12\%$) when compared to other diets. The vitamin content also showed that Akara-Igboro had the highest concentrations of vitamin B₂ and C ($21.67 \pm 0.02\text{g}/100\text{g}$ and $17.01 \pm 0.01\text{g}/100\text{g}$) respectively. The highest level of calcium was found in Ofeachara mixed with Mgbam and Garri ($0.08 \pm 0.01\text{mg}/100\text{g}$). This study revealed that these traditional diets are crucial sources of important nutrients. Increased consumption of these nutrient-rich diets will mitigate nutrition-related disorders.

Keywords Traditional Diets, Anti-nutrients, Nutritional Evaluation, Sensory Evaluation

nutritional support for the human body. It could be of animal and/or plant origin, which have some indispensable nutrients, like minerals, proteins, fats and vitamin. When food is ingested and absorbed by the human body, its primary aim is to sustain life, provide energy and enhance growth and development. Food is apparently unavoidable as it is one of the basic requirements of life. It can also be regarded as any substance that promotes growth, produces energy etc. after undergoing metabolism in the body [1]. Careful selection of foods can provide all the essential nutrients that are needed for the proper functioning of the human body [2].

In most developing countries in the world, like in Nigeria, there is usually an acute shortage in terms of availability of food and its supply which could affect the nutritional status of the people in these countries. Unavailability or shortage of food and its supply is a serious challenge causing nutritional quagmire in Nigeria mostly amongst infants and mothers. This effect can lead to malnutrition, impaired growth and development of children and low efficiency levels amongst mothers.

Traditional foods are commonly referred to foods consumed locally by a particular community [3]. These foods contribute significantly to the diet of individuals living within and outside that county. Nutritional compositions of some traditional foods have been investigated in Nigeria [4, 5, 6] and other countries [7, 8]. However, various traditional foods consumed in Nigeria have not been evaluated.

Vigna unguiculata locally known as Akidi as well as *Pennisetum purpureum* locally known as Achara which is normally mixed with baked melon seed locally known as Mgbam to produce a soup called Ofe-Achara locally consumed with Cassava flakes Garri and *Manihot esculenta* cake locally known as Akara-igboro are prevalent traditional diets consumed by the Ngwa people of South Eastern part of Nigeria. The safety and nutritional composition of these diets are not known and have not been

1. Introduction

Food is any substance taken for the purpose of providing

documented. Therefore, it is imperative to investigate the nutritional composition of these three selected traditional foods Akidi, Ofe-Achara and Akara-igboro commonly consumed by the Ngwa people of Nigeria in order to underscore the benefits, safety and possible risk associated with the consumption of the traditional diets.

2. Materials and Methods

2.1. Traditional Foods Selection

In this study, three traditional foods frequently consumed in Abia State, Nigeria were selected. The selection was based on data obtained from a pilot survey of eighty women living in Aba; a commercial city in Abia State. In accordance with the declaration of Helsinki, all participants signed a form of consent. Information on cooking procedures and ingredients were also obtained from the participants. This study was approved by the Nutrition and Toxicology Unit, Department of Biochemistry, University of Port Harcourt.

2.1.2. Source of Samples

The major raw ingredients and materials utilized in the preparation of the traditional foods used in the study were obtained from a local market known as Ahia Ohuru, in Aba, Abia State, Nigeria.

2.1.3. Rationale for the Recipe in the Diet Preparation

In order to work with the actual proportion of the condiments as would be prepared traditionally, the food stuffs for the preparation of the individual diet was weighed. The means of the weights for all the samples were compiled. Each diet was then prepared with these pre-determined preparations of the ingredients.

2.2. Preparation of Ofe Achara Mixed with Mgbam and Garri

This is a delicacy of the Abia people mostly the Ngwas. It is a local soup that is made from a vegetable known as Achara. Before the preparation of the soup, Baked Melon seed or Melon cake locally known as Mgbam was prepared. Three hundred grams of dehulled melon seed known as "Egusi" was placed in a wooden mortar alongside with 5g of sliced onions and ground until a paste was formed, then 5g of "Nsu", a thickener and 10ml of hot water was added. The "Nsu" helps the paste to be strong while the hot water helps in the extraction of oil from the melon. The melon paste was then molded into a desirable size using the hands. Then it was placed into 2000ml of boiling water in a cooking pot on a cooking gas and was allowed to boil for about 50mins under mild heat.

The soup was prepared by washing 300g of red meat, 150g of stockfish, 100g of dried fish which was placed inside a cooking pot and was allowed to heat for about 10mins on a gas cooker, after which 1g of table salt, 50g of crayfish, 10g of fresh pepper and about 500ml of the water which was used to cook the baked melon seed was added and allowed to boil for about 30mins, then 120ml of palm oil was introduced and allowed to boil for another 10mins. 10g of "Ofor" (a soup thickener) was introduced to the combination and allowed to cook for 10mins and 500grams of the already peeled, washed and chopped "Achara" and the baked Egusi were added into the mixture and were allowed to heat for 3mins and the soup was ready.

One hundred grams of "Garri" was mixed with 50ml of hot water and turned homogeneously in a bowl with a local stick until it becomes a paste. The "Garri" paste was used to serve the "Ofeachara mixed with mgbam" for a complete diet.

2.3. Preparation of Akidi

This is a special type of beans known as Cowpea (*Vigna unguiculata*) that is consumed amongst the Ngwa people, 90g of sliced onions, 1g of table salt, 500ml of water, 500g of cowpea locally known as Akidi and 50ml of palm oil. The beans were sorted to remove dirt and debris and washed thoroughly. After which, it was introduced inside a cooking pot filled with 5000ml of water on a cooking gas and was allowed to boil for about 50mins. Ten grams of fresh pepper, 90g of sliced onions was pulverized using a local pestle and mortar. After the cowpea was cooked until a paste-like product was formed, then 50ml of palm oil was added and was properly stirred. The ground 10g of fresh pepper, 1g of table salt and 90g of sliced onions was also added and stirred thoroughly to get a homogenous mixture and was allowed to stand for five minutes.

2.4. Preparation of Cassava cake Akara-igboro

This is a delicacy made from cassava just like 'Beans Cake' but this could be called 'Cassava Cake' in English. 400g of raw cassava was properly washed before and after peeling. A local grater was used to grate the cassava to a paste. After grating, a white cotton linen material was used to sieve out the water from the grated cassava. The cassava was then poured out into a bowl. Ten grams of fresh pepper, 50g of crayfish, and 80g of sliced onions were ground in a local mortar with pestle. Thirty milliliters of palm oil was added into the cassava residue in the bowl, and was mixed together, furthermore the ground mixture of fresh pepper and onions was added with 1g of salt and was thoroughly mixed. The resulting mixture was then moulded with hand into a desirable size and was deep fried into 250ml of palm oil.

Figure 1. Garri and Ofe achara

Figure 2. Akidi

Figure 3. Akara-Igboro

2.5. Preparation of Traditional Food Samples for Analysis

The prepared traditional food samples were oven dried at 90°C for 2 hours. The oven dried specimen were ground into a pulverized form with a karasa blender and preserved in an air-tight sample container and transported to the laboratory for analysis.

2.5.1. Sensory Evaluation

The sensory evaluation of the food sample was carried

out in the Nutrition and Toxicology Unit, Department of Biochemistry, University of Port Harcourt where the food was prepared. Ten non-teaching members of staff of University of Port Harcourt were randomly selected and trained. Each of the panelists was separated in different compartment and was served the freshly prepared “Akidi”, “Ofe-Achara” and “Akara-igboro”. The samples were evaluated for flavour, taste, colour, texture and overall acceptability by the Judges using a nine point hedonic scale, where 9 was the highest score and 1 the lowest. This was done in line with the technique described by Onwuka [9] and Amadi *et al.* [10].

2.5.2. Determination of Proximate Composition

Proximate analysis of the samples for crude fat, carbohydrate, ash, fiber, crude protein and moisture contents were determined using standard methods of AOAC [11].

2.5.3. Determination of Anti-nutrient Composition

The concentration of tannin was estimated using the Colourimetric strategy of Folin Denis. The oxalate and phytate content was determined by the technique illustrated by [11]. Cyanogenic Glycosides content was dictated by basic pikrate colourimetric strategy [12]. Alkaloids were estimated by alkaline precipitation strategy as described by Harbone [13]. Saponin content was evaluated by the twofold dissolvable extraction technique [13].

2.5.4. Determination of Vitamins

The vitamin composition of the food was samples was analyzed using High Performance Liquid Chromatography (HPLC)

2.5.5. Determination of Mineral Contents

The minerals were analyzed collectively using an Atomic Absorbance Spectrophotometer (AAS).

2.5.6. Statistical Analysis

All samples were subjected to statistical analysis using SPSS version 20.

3. Results and Discussion

The result of the sensory evaluation of the traditional diets is presented in Table 1, notably the most acceptable food was Ofeachara mixed with Mgbam and Garri, followed by Akidi and Akara Igboro. The Proximate composition of the cooked food samples utilized in the preparation of traditional diets is presented in Table 2 while the results of the anti-nutrient levels are presented in Table 3. The results of the vitamins and mineral levels of the traditional diets are presented in Table 4 and Table 5 respectively.

Table 1. Sensory Evaluation of the Traditional Diets

Sensory Attributes	Akidi	Ofeachara	Akara-Igboro
Appearance	6.67 ± 0.87 ^a	7.22 ± 1.09 ^a	5.89 ± 1.7 ^a
Taste	6.22 ± 2.64 ^a	8.22 ± 0.83 ^b	6.44 ± 1.13 ^a
Aroma	6.78 ± 10.20 ^a	7.56 ± 0.73 ^a	5.89 ± 1.05 ^a
Colour	7.00 ± 1.00 ^a	7.22 ± 0.67 ^a	6.11 ± 1.27 ^a
Texture	6.89 ± 1.27 ^a	7.67 ± 0.71 ^a	6.44 ± 1.42 ^a
Overall acceptability	7.11 ± 1.16 ^a	7.67 ± 0.87 ^a	6.11 ± 1.16 ^a

Values are presented as mean ± S.D of ten panelists

Values bearing different superscript letters and found on the same row are significantly different

The rating by the sensory panel showed that the appearance, aroma, colour and texture did not affect the different traditional diets significantly except in Ofeachara mixed with mgbam and garri, where the taste varied from Akidi and Akara-Igboro. In the overall acceptability, Ofeachara mixed with Mgbam and Garri (7.67) was the most preferable to the panelists followed by Akidi (7.11), even though the decrease in the overall acceptability in Akara Igboro (6.11) was significant ($p < 0.05$). The result was slightly different with the report of Ibanoglu [14] on Tarhana, a Turkish traditional food where commercial Tarhana was the most liked (8.20), although statistically no significant difference was observed in the general suitability between it and others.

Table 2. Proximate Composition (%) of the Traditional Diets

Constituents	Akidi	Ofeachara	Akara-Igboro
Protein	5.91 ± 0.05 ^c	4.13 ± 0.03 ^b	1.22 ± 0.13 ^a
Crude fibre	12.31 ± 0.01 ^c	3.05 ± 0.01 ^a	6.56 ± 0.05 ^b
Carbohydrate	45.18 ± 1.83 ^a	55.08 ± 4.66 ^c	50.77 ± 4.66 ^b
Lipid	18.00 ± 2.00 ^a	22.00 ± 2.00 ^b	38.02 ± 2.00 ^c
Ash	5.00 ± 0.00 ^a	6.67 ± 2.89 ^a	5.00 ± 0.00 ^a
Acid value	12.71 ± 0.32 ^a	12.15 ± 0.32 ^a	25.25 ± 0.57 ^b
Moisture	8.00 ± 0.66 ^b	8.41 ± 0.89 ^b	4.03 ± 0.41 ^a

Values are presented as mean ± S.D of triplicate determinations. Values on the same row with different superscript letters differ significantly at $p \leq 0.05$.

In the carbohydrate content of the cooked sample of the traditional food, Ofeachara mixed with Mgbam and Garri was the highest (55.08%) followed by “Akara Igboro” (50.77%) then Akidi (45.18%). The variation observed in the carbohydrate content may not be unconnected to the type and quantity of ingredients utilized in the preparation of the foods. The explanation for the high carbohydrate content demonstrated in “Akara Igboro” could perhaps be credited to the basic component Cassava, which is a good source of energy since it is very rich in carbohydrate, while for that of “ofeachara” mixed with “Mgbam and Garri”, the ingredient (garri) which is mixed with the diets after

preparing the food is also known to be high in carbohydrate. The carbohydrate content of “Akara Igboro” (50.77%) was comparable with the carbohydrate content of “Ntiti-Ikpa” (50.45%) a traditional diet of the Ikwerre people in South-South Nigeria as reported by Amadi *et al.* [15]. Also the carbohydrate composition of “Akidi” (45.18%) was comparable to that of “Khubez-Jabin” (44.20%), a traditional food regularly devoured in the Arabian Gulf States [16]. A significant difference was found in the carbohydrate constituent of the three diets.

The protein content of the traditional foods was highest in Akidi (5.91%) and lowest in Akara Igboro (1.22%). The high protein content in Akidi could be attributed to the basic ingredient Cowpea, While that of Ofeachara mixed with Mgbam and Garri could be attributed to the protein content ingredient stocked fish, red meat and crayfish used in the preparation of the traditional diet. The protein content of “Akara-Igboro” (1.22%) was low when compared to “Ekpan Nkukwo” (grated cocoyam and dried shrimps, 13.69%), as reported by Umoh [17]. A significant difference was also observed in the protein composition of the samples. The elevated protein content in Akidi connotes that it can contribute to the daily protein requirements for children, adults and patients already suffering from protein deficiency disorders and diseases [18].

Lipid content of the cooked samples of the traditional food was highest in Akara Igboro (38.00%) followed by Ofeachara mixed with Mgbam and Garri (22.00%). Crude fibre content was high in “Akidi” (12.32%), followed by Akara-Igboro (6.56%) and lowest in Ofeachara mixed with Mgbam and Garri (3.05%). These values compared well with those of other traditional foods like “Kantong” – 9.70% [19], sweet potato leaf soup- 5.88% [20] and “Bhat Kerela Bhaji”, a traditional recipe of Assam, India- 12.6% [21]. There was a significant difference in crude fibre composition of the diets. Since high crude fiber can improve digestibility, it also plays a vital role in the management and prevention certain disease conditions like cancer, diabetes, obesity and gastrointestinal disorders [22]. There is also a scientific proof that dietary fibre is helpful in the treatment of preset diabetes since it improves blood glucose tolerance [23].

The highest value for moisture contents of the cooked sample was Ofeachara mixed with Mgbam and Garri (8.41%) followed by Akidi (8.00%) and Akara-Igboro (4.03%). However, the moisture contents of all the traditional food samples were low compared to that of katong (32.47%) [19]. The high moisture content observed in some of the samples proposes that during storage the samples may be susceptible to bacterial spoilage. Elevated moisture content in a food sample has been implicated in microbial growth. Furthermore, the ash content of the traditional foods was high in Ofeachara mixed with Mgbam and Garri (6.67%) which indicates that Ofeachara mixed with Mgbam and Garri has the highest measure of

total mineral content which is a good nutritional attribution. This might be due to the ingredients crayfish and stockfish. The ash content of all the foods were more than 3.0% for that reason, they have nutritional relevance because [21] demonstrated leaves possessing ash content of 3% and above is ideal and recommended for food for humans. Melon has been reported to be rich in ash [18, 24]. The ash content of all the traditional diet studied were high compared to those of some traditional recipes of Assam, India [21] and some traditional dishes from Ikwerre in South Nigeria [15].

The acid value content was high in Akara Igboro (25.25%) followed by Akidi (12.71%) the lowest was in ofeachara mixed with Mgbam and Garri (12.15%). The acid value helps to measure or check for the degree of spoilage. It was high in Akara-Igboro because of the ingredient used to fry the cassava (Palm oil).

Table 3. Anti-Nutrient Composition (mg/100g) of the Traditional Diets

Anti-nutrient	Akidi	Ofeachara	Akara-Igboro
Phytate	0.37 ± 0.01 ^a	0.35 ± 0.01 ^a	0.40 ± 0.01 ^b
Alkaloid	45.13 ± 0.89 ^b	40.71 ± 0.88 ^a	50.00 ± 1.33 ^c
Tannin	12.21 ± 0.03 ^c	7.78 ± 0.05 ^b	5.81 ± 0.05 ^a
Saponin	17.56 ± 0.06 ^b	19.17 ± 0.17 ^c	14.68 ± 0.18 ^a
Oxalate	9.24 ± 0.44 ^a	11.88 ± 0.44 ^b	27.28 ± 0.88 ^c
Cyanogenic Glycoside	0.87 ± 0.11 ^a	1.17 ± 0.10 ^b	1.62 ± 0.12 ^c

Values are presented as mean ± S.D of triplicate determinations. Values on the same row with different superscript letters differ significantly.

Anti-nutritional factors are compounds inherent in plants which specifically help to decrease nutrient absorption [25]. These anti-nutrients commonly regarded as plants secondary metabolites have been lauded to be active biologically [26]. Some of them are useful in nutrition and pharmaceuticals industries while a variety still elicit very harmful biological responses [27].

The phytate constituent of the traditional diets was high in Akara-Igboro (0.40mg/100g) followed by Akidi (0.37mg/100g) and low in Ofeachara mixed with Mgbam and Garri (0.35mg/100g). However, the value is comparably lower than those of some dishes such as potato Kuba (9252mg/100g), Lentil soup (207mg/100g) and falafel (1355mg/100g) [28]. The high content of Akara-Igboro may be attributed to the presence of cassava, which is the major ingredient utilized in the preparation of the diets is famous for the high phytate content inherent in it. Akindahunsi and Oyeyayo [29] reported that phytate concentration of *Pleurotus tuber-regius* maize for some hours before grinding. Perias and Gibson [30] reported that soaking cereal in water for sometime may likely lead to inert diffusion of some water soluble phytate, K, Na and Mg which can be detached by pouring the water. There may also be the effect of thermal processing. Phytic produce covalent complexes with mineral ions in so doing

renders them unavailable for gastro-intestinal absorption [31] thus inducing deficiencies. The Saponin contents of the cooked samples was high in Ofeachara mixed with Mgbam and Garri (19.17mg/100g), followed by Akidi (17.56mg/100g) but was low in Akara-Igboro (14.68mg/100g). The saponin content of the samples were considerably high when compared with the work of Sezgin and Artik [32] on fourteen individual samples of Turkish Tahini Halvah that ranged from 3.20mg/100g to 17.20mg/100g. The decrease in the saponin content of the cooked sample was significant ($p < 0.05$) in Akara Igboro. This can be attributed to the effect of an incorporated approach that mixes a diversity of traditional food preparation and processing practices [33] such as thermal processing plus household pounding in the case of Akara-Igboro. The advantageous effects of saponins are mainly due to their anti-hypercholesterolemic activity [27]. Johnson [34] reported that saponin facilitates the uptake of materials from the gastrointestinal tract by increasing the permeability of mucosal cells in the intestine. Saponins pass through the body without causing deleterious effects because the body absorb them poorly [32] while Alkaloid was highest in Akara-Igboro (50.00mg/100g) and lowest in Ofeachara mixed with Mgbam and Garri (40.71mg/100g). The tannin content of the cooked samples of Akidi was 12.21mg/100g, Ofeachara mixed with Mgbam and Garri (7.78mg/100g) and lowest in Akara-Igboro (5.81mg/100g). In comparison to those of sweet potatoes diets consumed in Kwara State they values obtained were quite high, it ranged from 0.22mg/100g to 0.86mg/100g [20]. Tannins are reported to have possible anticarcinogenic effect [35]. Dietary tannins helps to decrease the injurious potentials of internal parasites in sheep thus improving the health of animals [36].

The Cyanogenic glycosides contents of the cooked samples was high in Akara-Igboro (1.62mg/100g) followed by Ofeachara mixed with Mgbam and Garri (1.17mg/100g) but was low in Akidi (0.87mg/100g). The Cyanogenic Glycosides composition of the samples was high in comparison to those of beniseed soup cooked for 15, 30, 45 and 60 minutes that range from 0.58mg/100g to 0.97mg/100g [37]. The high content of cyanogenic glycoside found in akara Igboro and Ofeachara mixed with Mgbam and Garri was attributed to the basic ingredients cassava which was used in both diets. High dose of HCN can pose a serious inhibitory effect on the respiratory cytochrome oxidase activity [38]. The oxalate content was high in Akara igboro (27.28mg/100g) followed by Ofeachara mixed with Mgbam and Garri (11.88mg/100g) but was low in Akidi (9.24mg/100g). The oxalate content of the samples was low compared to those of some sweet potato dishes consumed in Kwara State, Nigeria that ranged between 126.93mg/100g and 171.93mg/100g [20]. Oxalate is of great interest, because elevated concentrations of oxalate diets can enhance the possibility of renal calcium absorption [25].

Table 4. Vitamin Content (mg/100g) of the Traditional Diets

Vitamins	Akidi	Ofeachara	Akara-igboro
Vitamin A	17.97 ± 0.01 ^a	ND	ND
vitamin B ₁	4.08 ± 0.01 ^b	6.00 ± 0.59 ^c	0.83 ± 0.01 ^a
Vitamin B ₂	8.68 ± 0.02 ^a	ND	21.67 ± 0.02 ^b
Vitamin C	ND	14.62 ± 0.04 ^b	12.01 ± 0.01 ^a
Vitamin E	ND	0.08 ± 0.07 ^a	ND

Values are presented as mean ± S.D of triplicate determinations. Values on the same row with different superscript letters differ significantly at $p \leq 0.05$. ND = Not detected.

Vitamins are indispensable natural substances that are required in minute concentrations in the diets for normal functioning of the body, growth and maintenance of body tissue ³⁹. The vitamin of the food samples studied shows that the entire food sample contained an appreciable quantity of both water and fat soluble vitamins. Generally, vitamins B₂ and C has been seen to have the highest concentration in samples. This is attributed to their nature because they are soluble in water and as such not lost by most method of cooking such as boiling, steaming or soaking [40].

Vitamin A which was detected only in “Akidi” makes it an important diet in preventing dim light vision. While vitamin E, was detected only in “Ofeachara mixed with Mgbam and Garri”.

Table 5. Mineral Content (mg/100g) of the Traditional Diets

Mineral	Akidi	Ofeachara	Akara-Igboro
Copper	0.11 ± 0.00 ^b	0.08 ± 0.01 ^a	0.08 ± 0.00 ^a
Zinc	0.97 ± 0.36 ^a	0.72 ± 0.57 ^a	0.70 ± 0.02 ^a
Lead	ND	0.16 ± 0.15 ^a	ND
Calcium	7.92 ± 1.09 ^a	49.03 ± 2.45 ^c	12.44 ± 1.78 ^b
Iron	5.62 ± 0.71 ^c	4.14 ± 0.46 ^b	1.11 ± 0.37 ^a
Potassium	4.49 ± 0.06 ^a	9.13 ± 0.17 ^b	9.16 ± 0.24 ^b
Sodium	1.03 ± 0.01 ^b	1.06 ± 0.07 ^b	0.94 ± 0.07 ^a
Cadmium	ND	ND	ND

Values are presented as mean ± SD of triplicate determinations. Values on the same row with different superscript letters differ significantly at $p \leq 0.05$.

ND = Not detected.

Table 6. Na/K Ratio of the Traditional Diets

	Akidi	Ofeachara	Akara-Igboro
Na / K	0.2	0.11	0.10

Numerous dietary studies have demonstrated that multiple micronutrients deficiencies are prevalent in developing countries and have implicated poor availability of micronutrients and perhaps low dietary intake for the high pervasiveness of these multiple deficiencies [41]. This study reports the mineral composition of some selected aboriginal foods from Abia State. The metabolic roles of minerals and the amounts of them in the body vary considerably [39].

Sodium content of the traditional foods 1.06mg/100g in Ofeachara mixed with Mgbam and Garri to 0.94mg/100g in Akara-Igboro. The sodium content may be attributed to the table salt used in the preparation of the traditional foods. The sodium content of the foods in the present work is considered low compared to Ikwerre traditional foods in which sodium ranged from 3.61 to 3.48mg/100g [15]. Sodium is a key factor in retaining body water and the most important positive ion in the extracellular fluid. Elevated concentration of sodium in the body has been implicated in hypertension which results to increased loss of calcium in urine [39].

Potassium content of the diets ranged from 9.13mg/100g in “Ofeachara mixed with Mgbam and Garri” to 4.49mg/100g in Akidi. These values were normal compared to those reported in some Cameroonian household food which ranged from 197.33ppm to 134.3/100g. In the biological system, potassium also plays an analogous role with sodium but it is connected with lower blood pressure [39]. It helps the body to maintain acid base regulation and osmotic pressure [1]. Deficiency could lead to muscle cramps, irregular heartbeat and loss of appetite. For the preclusion of blood pressure in the body, sustaining the Na/k ratio in the body is sacrosanct and a ratio < 1 is recommended [42]. The Na/k of the 3 diets is less than one, hence the food samples are considered adequate in reducing the incidence of high blood pressure.

The calcium content of the traditional foods ranged from 49.03mg/100g in Ofeachara mixed with Mgbam and Garri to 7.92mg/100g in Akidi. The high level of calcium in “Ofeachara mixed with Mgbam and Garri” may be attributed to the stockfish and the vegetable “Achara” used during the preparation of the foods. Ogbonna [43] observed increase in calcium, potassium and phosphorous levels when African yam bean was fermented for the preparation of condiment. The values are high compared to those of sweet potato dishes consumed in Kwara State, Nigeria that ranged between 19.99mg/100g and 27.99mg/100g [44]. Calcium is the most abundant mineral in the body with 99% of calcium enclosed inside teeth and bones [39]. According to Allen [44] a deficiency of calcium in the body has been implicated in osteoporosis. The iron contents of the diets ranged from 5.62mg/100g in “Akidi” to 1.11mg/100g in “Akara-Igboro” which were almost similar in comparison to those reported by Amadi [15] on some traditional diets of Southern Nigeria that ranged from 0.21ppm to 6.03mg/100g. The recommended daily allowance for iron is 10mg/day and 15mg/day for men and women respectively which suggest that the selected food can meet the daily dietary requirements for iron [39]. This concurs to previous reports that most indigenous foods in Nigeria are rich in iron [45]. Iron deficiency is highly prevalent in most developing countries [46].

The copper contents of the traditional food samples ranged from 0.08mg/100g in “Ofeachara mixed with

Mgbam and Garri” and “Akara-Igboro” respectively to 0.11mg/100g in “Akidi”. The suitable limit for copper consumption for human is 10ppm. Copper levels were low when compared to those recorded in Ikwerre traditional foods [15]. The entire food sample examined had their copper contents below the maximum acceptable limit of 2.00ppm set by WHO. Copper is an indispensable nutrient that plays a vital role in the human body by performing as a ligand to numerous enzymes and proteins [47].

The zinc content of the traditional food samples ranged from 0.70mg/100g in “Akidi”. The tolerable limit for human consumption of zinc is 150ppm [48]. Zinc contents were higher when compared to those recorded in Ikwerre traditional foods [15]. The results got for Zn in the food samples were below the maximum tolerable limit of 3.00ppm documented by WHO but they are within the normal range of 0.1 – 3.0ppm for vegetables and fruits. Zinc is an indispensable trace element in the body; it supports normal development and growth during childhood and pregnancy [49]. High levels of zinc and copper cause diarrhea, depressed immune function, impairment of growth and reproduction [50]. According to WHO [51] report deficiency of zinc and copper occur especially due to reduced dietary intake or due to decreased availability from foods.

The lead content of the food samples was 0.16mg/100g in “Ofeachara mixed with Mgbam and Garri” but was not detected in “Akidi” and “Akara-Igboro”. The concentration of lead was within the tolerable limit of 0.1mg/100g [52]. Lead enters the human body via food, water and air and is not easily removed by washing vegetables and fruits [53].

4. Conclusions

The nutrient constituents of the traditional foods (Akidi, Akara-Igboro and Ofe-Achara mixed with Mgbam and Garri) suggest that they are rich sources of indispensable nutrients. Consequently, they may make significant contributions to consumptions of fibre, proteins, carbohydrates as well as some minerals and vitamins. However, the presence of anti-nutrients may possibly affect the exploitation of some of the micronutrients present in the diets. On the other hand, Ofeachara mixed with Mgbam and Garri was more preferable in the overall acceptability of the three traditional foods.

Acknowledgements

The authors received no external funding for this study.

Conflict of Interest

The authors declare that there is no conflict of interests regarding this article.

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