

Micronutrient Composition of Selected Indigenous foodcrops in Okigwe Local Government Area, Imo State

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Abstract: This study assessed micronutrient profile of selected indigenous foodcrops. The selected foodcrops includes Nchuanwu (*Ocimum gratissimum*), Ukazi (*Gnetum africanum*), Utazi (*Gongronema latifolium*), Uziza (*Piper guineense*), Ofe (*Solanum macrocarpon*), Okwurubeke (*Carica papaya*), Ukpa (*Tetracarpidium conophorum*), Onugbu (*Vernonia amygdalina*), and Ugu (*Telferia occidentalis*) which were purchased from a local market in Okigwe Local Government Area of Imo state. The proximate and micronutrient composition of the foodcrops were determined by official method of AOAC; while means and standard deviation were used to analyze the data variables. These indigenous foodcrops were found to be good and cheap sources of micronutrient (zinc, iron, calcium, and vitamin A) and protein. However, they contain some anti-nutrients such as phytate and tannins which are within normal range. The result confirms that our indigenous fruit, seeds and vegetables are good sources of important minerals and vitamins. There is need for massive enlightenment of the populace and policy makers for increase in production, better processing, preservation and consumption of these indigenous foodcrops.

Key words: Foodcrops, seeds, micronutrient, vegetables, indigenous.

I. Introduction

Those nutrients required in small or minute quantities are called micronutrients while those required in large amounts are called or referred to as macro nutrients. Micronutrients are a combination of vitamins and minerals, which are all found in our indigenous foodcrops. Foods from natural environments which have been incorporated into a group of indigenous people's cultural food use patterns are referred to as indigenous food [1]. Sustainable use of indigenous food crops will help in addressing the problems of food security both in quality and quantity at local and national levels [2]. Moving to a healthier vegetable-rich diet is necessary, especially now that the world is experiencing an undesirable impact of intensive livestock production system on planet's resources and ecosystems [3].

With a great increase in global malnutrition, reports have it that about 2-3 billion people are malnourished [4], micro nutrient deficiency has niches within the ecological confines of the hydra headed malnutrition [5]. Apart from the hidden hunger, diseases are transiting from, the usual protein energy malnutrition, stunting and wasting in most developing countries to the more complex non communicable diseases such as cardiovascular heart disease, cancer and obesity [6]. This trend in nutrition transition is gaining an upper hand as people; even those in the rural areas are neglecting indigenous food crops which are cheaper and healthier, for the more refined high salt, high sugar processed foods with low fibre. According to [7], traditional food system plays significant roles in meeting the nutritional status, health and wellbeing of indigenous people. Among the important contributors to Africa's high burden of malnutrition is poor nutrient intake resulting from nutritionally inadequate diets and poor feeding practices. Dietary diversity, which entails the intake of variety of foods across and within food groups and species, is shown to be crucial for adequate nutrient intake and optimal nutritional status, especially in developing countries [2].

Furthermore, food production systems in the majority of African countries have focused mainly on few species of crops, (mainly cereal grains and cash crops) with little or no attention to production of nutritious non-food grain commodities such as pulses, vegetables, fruits, and oilseeds, from indigenous species of crop, [2]. Probably this may be due to their inadequate knowledge of the nutrient composition of these indigenous food crops and its contribution to dietary intake. These indigenous food crops contain both macro and micro nutrients that are essential for proper growth and functioning of the human body. Nigeria is a multicultural society with different indigenous food crops, indigenous to the different ethnic and cultural societies such as the Igbos.

This study therefore aimed at determining the proximate and micronutrient composition of some selected indigenous foodcrops. These include: Nchuanwu (*Ocimum gratissimum*), Ukazi (*Gnetum africanum*), Utazi (*Gongronema latifolium*), Uziza (*Piper guineense*), Ofe (*Solanum macrocarpon*), Okwurubeke (*Carica papaya*), Ukpa (*Tetracarpidium conophorum*), Onugbu (*Vernonia amygdalina*), Ugu (*Telferia occidentalis*)

II. Objectives of the Research

The objectives of the study include:

- i. to ascertain the proximate composition of selected indigenous foodcrops in Okigwe
- ii. to estimate the zinc, iron, vitamin A, calcium and fibre contents of the selected indigenous foodcrops
- iii. to identify the phytate and tannin levels of selected indigenous foodcrops
- iv. to make appropriate recommendations based on the findings.

Research Questions

RQ1: What is the proximate composition of the selected indigenous foodcrops?

RQ2: What are the zinc, iron, vitamin A, calcium and fibre contents of the selected indigenous foodcrops?

PQ3: What are the phytate and tannin levels of selected indigenous foodcrops?

III. Materials and Methods

Study Location

The foodcrops studied were purchased from a local market in Okigwe Local Government Area of Imo State. This location was purposively selected based on the fact that most of the indigenous foodcrops were grown and consumed in the area. It is bordered by the north by Umuchieze, in the east by Uturu, in the south by Nneato, all in Abia state.

Table 1: Foodcrops used for the study:

Local name	English name	Scientific name
Nchuanwu	Scent leaf	<i>Ocimum gratissimum</i>
Ukazi	Hard leaf	<i>Gnetum africanum</i>
Utazi	Bittersweet leaf	<i>Gongronoma latifolium</i>
Uziza	Pepper leaf	<i>Piper guineense</i>
Efe	Garden egg	<i>Solanum macrocarpon</i>
Okwurubekee	Paw-paw	<i>Carica papaya</i>
Ukpa	Conophor	<i>Tetracarpidium conophorum</i>
Onugbu	Bitter leaf	<i>Vernonia amygdalina</i>
Ugu	Pumpkin	<i>Telferia occidentalis</i>

Sample selection/preparation

Fresh samples of the selected food crops purchased were plucked to obtain the edible portion. Then each of the samples was divided into two. The first sample was for moisture determination and the second half was for proximate and micronutrient analysis. These samples were dried in a drier, milled and packed for final analysis. The analyses were carried out in the Department of Home Science, Nutrition and Dietetics and Crop Science Laboratory at the University of Nigeria, Nsukka.

IV. Chemical Analysis

4.1 Moisture Determination

This was determined by the official method AOAC (2012) using standard hot air oven. About 5g of each sample were placed in an air oven 100 °C until constant weight was obtained. Moisture was then calculated using this formula.

4.1.2 Moisture content determination calculation

$$\% \text{ moisture} = \frac{\text{wet weight} - \text{dry weight}}{\text{Wet weight}} \times 100$$

4.1.3 Protein Determination

Nitrogen was determined by the microkjedahl method. The percentage nitrogen was converted to crude protein by multiplying it by a conversion factor of 6.25.

4.3 Fat Determination

Fat content of samples was determined by Soxhlet extraction method AOAC (2012). Also 2g of each sample were extracted using Soxhlet extractor with petroleum ether B.P. (40-60°C) for 1hr. The solvent free fat was dried in an oven and then cooled in a desiccator and weighed. The content was expressed as the percentage of the raw material.

4.4 Ash Determination

The ash content was determined by the official method of AOAC [8]. Two(2)g of each milled samples were weighed into pre-weighed clean silica dishes. The samples were charred at 500⁰C in a muffle furnace until light grey ash was obtained. Both the dishes and their contents were removed from the Crude furnace and allowed to cool at room temperature in desiccators. Final weights were recorded to obtain ash weight.

4.5 Fibre Determination

The crude fibre content of the samples was determined by the official method AOAC [8].

4.6 Carbohydrate Determination

Carbohydrate content was determined by difference. The determined percentage of crude protein, fat, ash and moisture were summed up and the value subtracted from 100%.

4.7 Micronutrient Determination

Minerals such as iron, zinc and calcium were estimated using atomic absorption spectrophotometer. Vitamin A (B- carotene and lycopene)were determined by AOAC (2012) procedure for minerals and vitamins.

4.8 Phytate and Tannins Analysis of the Samples

4.8.1 Phytate: This was determined by a photometric method adapted from the method of [9]. Five (5) grams of each sample were extracted with 2.4% HCL 0.1M NaCl was added to elude inorganic phosphorus and 0.7M NaCl added to remove phytate. 1ml of modified wade reagent was added and readings the spectrophotometers were taken at a wavelength of 500nm on a spectrophotometer.

4.8.2 Tannin: This was determined by method as determined by [10]. Also, 0.5g of each sample was extracted with 3ml methanol. The filtrate was mixed with 50 ml water. 3ml of 0.1M FeCl₂ in NHCl and 0.8M K₂Fe(CN)₆ were added to 0.1ml of the solution. The extract was read at wavelength of 720nm on a spectrophotometer

Data Analysis

Laboratory analyses on samples were done in triplicate. Means and standard deviations of means were calculated for variables.

V. Results

Table 2: Proximate Composition of Selected Indigenous Foodcrops per 100g Edible Portion.

Foodcrops	Moisture	Fat	Protein	Fibre	Ash	CHO
Nchuanwu (<i>Ocimum gratissimum</i>)	90.0	0.1 ± 0.1	1.8 ± 0.1	0.5 ± 0.1	1.3 ± 0.1	6.3 ± 0.1
Ukazi (<i>Gnetum africanum</i>)	63.0	0.9 ± 0.2	3.3 ± 0.1	4.9 ± 0.1	5.1 ± 0.1	22.8 ± 0.2
Utazi (<i>Gongronema latifolium</i>)	86.7	0.4 ± 0.4	1.3 ± 0.0	1.7 ± 0.1	1.8 ± 0.1	8.1 ± 0.1
Uziza (<i>Piper guineense</i>)	90.0	0.2 ± 0.1	2.7 ± 0.1	1.9 ± 0.2	1.7 ± 0.2	3.5 ± 0.1
Garden egg (<i>Solanum spp</i>)	85.0	0.5 ± 0.1	3.0 ± 0.1	1.9 ± 0.3	2.4 ± 2.8	7.2 ± 0.1
Paw-paw (<i>Carica papaya</i>)	91.0	0.2 ± 0.1	1.8 ± 0.2	1.3 ± 0.1	0.7 ± 0.1	5.0 ± 0.7
Ukpa (<i>Tetracpidium conophorum</i>)	71.0	1.5 ± 0.1	7.0 ± 0.1	6.8 ± 0.1	1.7 ± 0.2	11.8 ± 0.1
Bitter leaf (<i>Vernonia amygdalina</i>)	79.0	0.4 ± 0.2	5.4 ± 0.1	2.8 ± 0.1	2.5 ± 0.1	9.9 ± 0.1
Ugu (<i>Telferia occidentalis</i>)	89.0	0.2 ± 0.2	1.0 ± 0.1	1.7 ± 0.1	1.7 ± 0.1	6.4 ± 0.1

Figure 1

Means ± SD of triplicate determinations

Table 2 showed the proximate composition of selected indigenous foodcrops. Ukpa had protein content of 7.0g, paw-paw 1.8g, Bitter leaf 5.4g while ugu had 1.0g per 100g edible portion respectively.

Ukpa had a fat content of 1.5g, paw-paw had 0.2g, ukazi 0.9g, uziza 0.2g, nchuanwu had 0.1g, utazi 0.4g, garden egg 0.5g, ugu had 0.2g and that of bitter leaf was 0.4g per 100g edible portion respectively.

More so, the fibre content of paw-paw was about 1.3g per 100g, garden egg (ofe) 1.9g, while that of ukpa was about 6.8g per 100g of edible portion respectively. The selected indigenous vegetables, ukazi had fibre content of 4.9g, uziza 1.9g, nchuanwu 0.5g, utazi 1.7g, ugu 1.3g, and bitterleaf 2.8g, per 100g, edible portion respectively. Ukazi had ash content of 5.1g, bitterleaf 2.5g and paw-paw 0.7g per 100g edible portion respectively. Ukazi had carbohydrate content of 22.6g per 100g while bitterleaf had 9.9g and ukpa 11.2g per 100g edible portion respectively.

Table 3: Micronutrient and anti-nutrient composition of selected indigenous foodcrops per 100g edible portion

Foodcrops	Zinc in mg	Iron in mg	Calcium in mg	Retinol in (µg)	Phytate in mg	Tannin in mg
RE)						
Nchuanwu (<i>Ocimumgratissimum</i>)	0.17±0.1	1.10±0.1	0.28±0.1	93.3±1	19.0±2	5.49±0.1
Ukazi (<i>Gnetumaffricanum</i>)	0.15±0.0	4.9±0.1	0.31±0.0	141.8±9	66.0±3	15.99±0.1
Utazi (<i>Gongronematifolium</i>)	0.18±0.1	0.76±0.1	1.65±0.1	45.0±1	27.3±2	9.33±0.1
Uziza (<i>Piperguineense</i>)	0.13±0.1	0.33±0.2	0.15±0.1	43.9±1	19.0±2	3.32±1
Garden egg (<i>Solanum spp</i>)	0.10±0.0	2.00±0.1	1.6±0.0	43.6±1	32.0±4	5.33±0.1
Paw-paw (<i>Carica papaya</i>)	0.13±0.1	0.62±0.5	0.47±0.1	15.1±2	16.5±1	4.16±0.1
Ukpa (<i>Tetracapidiumconophorum</i>)	0.10±0.0	3.75±0.1	0.24±0.0	44.8±1	46.5±3	7.47±0.1
Bitterleaf (<i>Vernoniaamygdalina</i>)	0.19±0.3	0.88±0.1	1.95±0.3	66.7±1	33.4±2	10.98±0.0
Ugu (<i>Telferiaoccidentalis</i>)	0.10±0.1	0.48±0.1	0.26±0.0	50.9±1	19.8±2	3.13±0.1

Means +SD of triplicate determination
RE=Retinol equivalent

Table 3 showed the micronutrient and anti-nutrient content of selected indigenous foodcrops. Utazi had zinc content of 0.2mg per 100g, ugu 0.2mg, paw-paw 0.1mg garden egg (ofe) 0.1mg and ukpa 0.1mg per 100g edible portion respectively.

However the iron content of ukazi was 4.9 g per 100g edible portion, ukpa, 3.6g, utazi 1.8mg, garden egg (ofe) 2.0g and bitter leaf 0.9mg per 100g. The iron content of uziza was about 0.3mg, paw-paw 0.6g while that of ugu was about 0.5 mg/100g edible portion respectively.

Calcium value of bitterleaf was about 2.0mg per 100g, utazi 1.7mg/100g, garden egg (ofe) 1.6g/100g, uziza 0.2g/100g ukazi 0.3mg/100g edible portion respectively.

VI. Discussion

Ukpa oil seed had the highest protein content 7.0g per 100g of edible portion. Paw-paw a fruit had protein content of 1.8g per 100g edible portion. Among the selected indigenous vegetables, bitterleaf had the highest protein content of 5.4g while ugu 1.0. also ukpa had fat content of 1.5g per 100g of edible portion the high fat content could be attributed to the fact that ukpa is an oil seed.

More so, the high fibre content of ukpa, 6.8g per 100g edible portion was of good quality because studies have shown that fibre reduces blood cholesterol probably by binding bile salts and cholesterol derivatives [11]. This is good because excess cholesterol in the body has been implicated as a contributory factor to non-communicable diseases such as gallstones, atherosclerosis and stroke [12]. Ukpa had a potential for being used in dietary formulation or supplementing low protein.

Therefore an attempt should be made to provide low cost complementary foods that are based on ukpa. Also, ukpa is very rich in fat content and thus can be used to produce vegetable oils. Ukpa contains appreciable quantities of carbohydrate 11.2g/100g edible portion thus, Ukpa can make substantial contribution to energy intake of those who consume the seeds. Paw-paw is very rich in carbohydrate and it serves as snacks and usually taken at lunchtime. Carbohydrate is necessary in the diet since it has a protein sparing function [13; 14&15].

Uziza, bitterleaf and garden egg were also high in protein and therefore could be added to our diet to upgrade the nutrients content. The consumption of ukazi which was also high in fibre (4.9g/100g edible portion) should be encouraged.

VII. Micronutrient and Anti-nutrient Composition of Selected Indigenous Foodcrops

Inadequacy of vitamin A, iron and iodine are the major micronutrient problem in the world [16]. The result revealed that addition of *Telferia* with high zinc content in our daily diet will help to increase growth rate [17]. Utazi with high iron and calcium content and is added to the diets of lactating mothers and iron plays a vital role in blood formation [13]. Utazi could also be used as food supplements in our diet as it was found to be high in calcium. It could thus play a useful role in bone formation.

Most of the food items that were rich in micronutrient contained anti-nutrients (phytate and tannins). Thus the portion made available for consumption was low. However, plant proteins were important source of incomplete protein in the diet of human beings. Thus, plant proteins should not be used as the sole source of protein for children, pregnant and lactating mothers [18].

The result confirmed that our indigenous fruits, seed and vegetables were sources of important minerals and vitamins. This is in line with the findings of [19] that Nigeria leafy vegetables contributed a significant proportion of the zinc, iron, calcium and carotene to the traditional diet.

It was observed that the edible portion of iron found in ukazi was higher than in any other vegetables studied. Thus, increasing the usage of our indigenous vegetables especially ukazi in our diet will help in blood cell formation and reduce the incidence of anaemia in Nigerian children and pregnant women. Moreover, it did seem that a significant per cent of the daily iron requirement for the average Nigerian could be met through judicious selection and consumption of leafy green vegetables especially ukazi. Edible calcium content in bitterleaf was higher than in any other leafy vegetable studied. This indicated that addition of bitterleaf in our diet will help in bone formation. Also, the 0.31mg calcium per 100g in ukazi was in line with the findings of Ibe [20]. In the view of these findings, our indigenous foodcrops are rich in nutrients. They could contribute to the nutritional quality of meal and also make for variety in the choices of available foods. In addition, it will obviously lead to achieving household and consequently national food security.

VIII. Conclusion

Indigenous fruits seeds and vegetables have been shown to make substantial contribution in meeting the nutritional needs of the population in both urban and rural areas especially in times of seasonal scarcity of staple food crops. This work has provided some additional information on the micronutrient contents of some underutilized indigenous fruits seeds and vegetables.

The analysed indigenous fruit, seed, and vegetables were rich in the following nutrients; zinc, iron calcium and vitamin A. Ukpa has the potential for improving local diets. The high protein content of uziza and bitterleaf could help in meeting individual protein requirements, if the intake is sufficiently high. The major constraint for the optimal use of ukpa was its long cooking time and high fuel consumption. Appropriate techniques for reducing fuel consumption rate and cooking time should be developed. Further detailed research on its nutritional contribution can be suggested. This will help to maximise the use of our rich indigenous food crops which will lead to the improvement of the nutritional status of the Nigerians.

IX. Recommendations

Based on findings the following recommendations are made.

- I. There is need to enlighten the populace on the nutritional potential of these indigenous foodcrops.
- II. The government should make policies that will promote the production of these indigenous foodcrops. This is necessary now that government is emphasizing on agricultural sector as a means of increasing food production, hence, ensuring food security. .
- III. Ukpa seed should be used in dietary formulation or in supplementing low protein foods/complementary diets.

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