International Journal of Nutrition and Food Sciences
2023; 12(1): 1-9
http://www.sciencepublishinggroup.com/j/ijnfs
doi: 10.11648/j.ijnfs.20231201.11
ISSN: 2327-2694 (Print); ISSN: 2327-2716 (Online)

Assessment of Micronutrient Contents of Standardized Commonly Consumed Native Soups Among Nupe People of Niger State, Nigeria

Abduljelili Uthman[1, *], Kola Mathew Anigo[2], Sunday Ene-Ojo Atawodi[3], Amanabo Musa[1], Abdulrahman Abdulazeez[4]

[1]Department of Biochemistry, Ibrahim Badamasi Babangida University, Lapai, Nigeria

[2]Department of Biochemistry, University of Abuja, Abuja, Nigeria

[3]Department of Biochemistry, Federal University, Lokoja, Nigeria

[4]Department of Chemistry, Ibrahim Badamasi Babangida University, Lapai, Nigeria

Email address:

jelilibch@gmail.com (Abduljelili Uthman), mkanigo@yahoo.com (Kola Mathew Anigo), sunday.atawodi@fulokoja.edu.ng (Sunday Ene-Ojo Atawodi), musaamanabo@gmail.com (Amanabo Musa), aabdulazeez@ibbu.edu.ng (Abdulrahman Abdulazeez)

[*]Corresponding author

To cite this article:

Abduljelili Uthman, Kola Mathew Anigo, Sunday Ene-Ojo Atawodi, Amanabo Musa, Abdulrahman Abdulazeez. Assessment of Micronutrient Contents of Standardized Commonly Consumed Native Soups Among Nupe People of Niger State, Nigeria. *International Journal of Nutrition and Food Sciences*. Vol. 12, No. 1, 2023, pp. 1-9. doi: 10.11648/j.ijnfs.20231201.11

Received: May 31, 2022; **Accepted**: June 29, 2022; **Published**: January 10, 2023

Abstract: Assessment of micronutrient contents of standardized commonly consumed native soups among Nupe people of Niger state was carried. The ingredients for the recipes of six (6) commonly consumed soups were standardized, prepared and evaluated for some mineral and vitamin contents using standard procedures. The results obtained showed that "eni kuka", "eni kpanmi", "eni tsuku", "eni nungbere", "eni ezowa" and "eni emagi" are the most commonly consumed soups among the Nupe people. The mineral compositions revealed that calcium content of "eni kpanmi" (0.027 ± 0.08 mg/100g as consumed) recorded the lowest concentration. "Eni ezowa" had the highest content for magnesium (0.093 ± 0.12 mg/100g) and was significantly different ($p < 0.05$). The zinc content ranged from 0.016 ± 0.05 to 0.051 ± 0.05 mg/100g and level of iron was highest in "eni ezowa" (0.041± 0.03 mg/100g). The potassium concentration of the soups ranged from 0.022 ± 0.01 – 0.055 ± 0.02 mg/100g while the sodium content was highest in "eni ezowa" (0.059 ± 0.04 mg/100g). The result also revealed that "eni kuka" (0.06 ± 0.04 mg/100g as consumed) had the highest concentration of β–carotene. The vitamin B1 content of the soup was significantly ($p < 0.05$) higher in "eni ezowa" than the other soups. The vitamin B2 content ranged from 0.08±0.02 to 12.23 ± 1.86 mg/100g as consumed with "eni ezowa" having the highest content. Vitamin B3 content of kuka soup was significantly ($p < 0.05$) higher than the other standardized soups and vitamin C concentration of the soups ranged from 0.20 ± 0.02 – 0.44 ± 0.04 mg/100g as consumed. The soups contain appreciable amount of minerals and vitamins B1 and B2, which could contribute in meeting the recommended dietary intake of the people.

Keywords: Micronutrient, Native Soup, Standardized Foods, Vitamins and Nupe People

1. Introduction

All living cells in the body required foods for proper growth and development [1]. Metabolic and cellular functions required foods as a major source of nutrient. Food based products are classified based on consumption, source, native and patterns of processing [1]. Advances in food and nutritional sciences shows that food contains certain bioactive substances that provide some health benefits to human such as cancer risk reduction and modification of tumor behaviour [2].

Micronutrients are essential nutrients required in small

amount that protect the body against diseases, maintenances of good health and growth [3, 4]. Inadequate intake of micronutrients also known as "hidden hunger" has contributed to the increase rates of illness and death due to infectious diseases and disability such as mental impairment [5]. Therefore, leafy vegetables have the potential to protect against hunger, malnutrition, under-nourishment and to eradicate poverty [6]. Deficiency in key vitamins and minerals, particularly vitamin A, iodine, iron and zinc have been reported to affect more than 2 billion people in the world today [7]. Low income people suffered more deficiency in more than one micronutrient. Inability of the people to access these micronutrient-rich foods such as fruits, vegetables, animal products and fortified foods has led to this deficiency, because the foods are too expensive to buy or are locally unavailable for the people [7].

Soup is made from combination of ingredients like meat and vegetable with stock, juice, water or another liquid. It is a liquid food, which is usually served warm or hot (but may be cool or cold). Soup is a special sauce that accompanies the major Nigerian starchy foods such as yam, rice, cassava and its product, plantain and cereals. Nigerian soups are extremely well-loved because of simple method of preparation and delicious taste. It is very essential to Nigerian food recipes and a good source of micronutrients [8]. One delicacy indigenous to Nupe people is "Eni ikan" (catfish stew), made of fresh catfish, dry chili pepper, onions, palm oil, stock cubes and salt. "Eni ikan" (catfish stew) is good for all kinds of food; such as "ejeboci" (mashed food) like rice, yam, etc. Soups are good sources of protein, calorie, vitamin and other components. Adequate consumption of traditional foods and their products aid in combating Protein Energy Malnutrition (PEM) and micronutrient deficiencies, hence the need for diversification. The knowledge of the nutritional composition of traditional soups will ease therapeutic meal planning and service. Hence, all Nigerians need to know the nutritional contents of their local food and soup. Lack of information on nutritional compositions may result into protein energy malnutrition and micronutrient deficiencies.

Vegetables are important constituents of any type of diet in many Nigerian homes as it add variety, flavor, colour and taste to the menu. Vegetable contributed substantially to protein, mineral, vitamins, fibre and other nutrients which are in short supply in most daily diets [9]. A substantial portion of the diet in the preparation of soups and stews contain vegetable, which has gained a widespread acceptance as a dietary constituent in Nigeria [10]. Vegetables are economically and nutritionally important to human. Economically, help many rural women to generate income and relatively cheap to grow. Nutritionally, provides the body with vitamins, minerals, dietary fibre and water to aid digestion. Minerals such as potassium, sodium, calcium, iron, zinc and phosphorus may be derived from vegetables. Thiamine, ascorbic acid, riboflavin and β-carotene are in high contents in leafy vegetable. Fresh vegetable contain over 70% of water and many phyto-chemical substances that can prevent diseases and promote health [11]. Vegetables can be serving in every meal, as salad or side dish with main meal. It has medicinal benefit and a good source of proteins, vitamins and minerals [12]. Standardized food recipes according to National Food Service Management Institution (NFSMI) [13] is defined as a recipe that produce the same results and yield every time when the exact procedures are used with the same type of equipment, quantity and quality of ingredients. Recipe standardization produces nutritionally adequate foods while being cost-effective and meeting meal pattern requirements for reimbursement. Additional benefits may include; producing consistent food quality, yield can be predictable, providing customer satisfaction, consistent nutrient content, food cost control, efficient purchasing procedure and inventory control [13]. This study therefore aims at assessing the micronutrient contents of standardized commonly consumed native soups among Nupe people of Niger state, Nigeria.

2. Materials and Methods

2.1. Study Area

The study areas are Bida and Lavun LGAs of Niger state, Nigeria. Bida is located on geographical coordinates: 9°05′N 6° 01′ E, an area of 50sq km and a projected population of 260,700 as at 2016. Bida is the ancient city of Nupe kingdom in Nigeria and known for production of traditional crafts, notably glass, bronze, art crafts and brass wares. Lavun LGA has its headquarters in Kutigi town located in the southern area of Niger state at 9°12′ 00″ N 5°36′ 00″ E. The Kaduna River is at the eastern border of the LGA, has an area of 2,835sq km and a projected population of 294,700 as at the 2016 census.

Nupe-speaking people live near the Confluence Rivers of Niger and Kaduna State of Nigeria. There are about 4.5million Nupe people, with the largest population found in Bida [14]. Nupe land is an agrarian population; the economy and social life revolve round agriculture with the people mostly active farmers. Those that live in the riverine areas are mostly fishermen and their wives actively engaged in processing and selling of fish. Major agricultural produce in Nupe land include rice, sorghum, millet, sugarcane, melon, groundnut, vegetables, yam and fishing.

2.2. Study Design

A cross sectional survey was carried out in order to document the commonly consumed native soups by Nupe people while standardization of the soup recipes was done by identifying, weighing all the ingredients, documentation of processing and preparation methods, with nutrient analysis carried out in the laboratory.

2.3. Sampling Technique

Stratified sampling technique was used in which the South senatorial district where most of the Nupe people reside in the state was stratified into North and South and one local government was picked from each stratum. Bida and Lavun LGAs were randomly selected, then clustered into wards

from which, seven (7) wards were randomly selected from the two (2) LGAs for the survey. Bida LGA has 14 wards from which four (4) wards were randomly selected whereas Lavun with 11 wards from which three (3) wards were also selected to give a total of seven (7) wards selected from the two (2) LGAs. Based on the responses received after the administration of the survey questionnaire, the most commonly consumed soups were selected for standardization and then prepared in the laboratory.

2.4. Sample Collection

All the soup ingredients used were bought from Estu Musa market in Bida town of Niger state.

2.5. Standardization of the Soup Recipe

All the ingredients used for the soups recipe were standardized by weighing the items on a balance (ScoutPro, Ohaus) and water was measured using graduated cup. The weight of the empty pot used was determined using weighing scale (CAMRY Emperor, China) and the yield was obtained by weighing the pot and its contents on the weighing scale. The collected recipes were standardized using a modified National Food Service Management Institution (NFSMI) [13] methods which are in three phases: recipe verification, product evaluation and quantity adjustment. In this study, the two major stages of recipe verification phase (recipe review and recipe preparation), was carried out. This was done on one recipe at a time to find out if the recipe contained the following information: (a) recipe title, (b) recipe category, (c) ingredients, (d) weight/volume for each ingredient, (e) preparation instructions (directions), (f) cooking temperature and time, if appropriate, (g) Serving size, (h) recipe yield, (i) equipment and utensils used.

Table 1. *List of Soups Prepared.*

Common Name	Scientific Name	Nupe Name
Kuka (Baobab powder leaves)	*Adansonia digitata*	Eni kuka
Okra (Powder)	*Abelmoschus esculentus*	Eni Tsuku
Okra (Fresh)	*Abelmoschus esculentus*	Eni Kpanmi
Beans soup	*Vigna ungucuilata*	Eni Ezowa
Fresh Sorrel calyx	*Hibiscus sabdariffa*	Eni Emagi
African custard apple calyx	*Annona senegalensis*	Eni Nungbere

2.6. Methods of Soup Preparation

2.6.1. "Eni Kuka" (Kuka Soup)

A pre-weighed aluminum pot was kept on a stove to allow the pot to dry and then 50g of palm oil was added and allowed to be heated for 2 minutes. Exactly 14g of fresh pounded pepper with 20g of onion was added to the oil, then 15g of "kula tsaka" (Locust bean), maggi (12g), and salt (3g) were added. Exactly 500ml of distilled water was added to the contents in the pot and boiled for 10 minutes, after which 50g of dried fish was added and further boiled for another 5 minutes. The fish was removed and 50g of "kuka" powder was added slowly with constant smoothening with cooking broom. Then 200ml of distilled water was further added to the soup, the fish was returned to the pot and boiled for another 5 minutes. The pot was brought down from the stove, cooled, the pot and its contents were weighed to determine the yield (NFSMI, 2010); (Table 2).

2.6.2. "Eni Tsuku" (Okra Soup, Powder)

A pre-weighed aluminum pot was put on a stove to allow the pot to dry and then 50g of palm oil was added and allows to be heated for 2 minutes. Exactly 14g of fresh pounded pepper with 20g of onion was added to the oil and then 15g of "kula tsaka" (Locust bean), maggi (12g), and salt (3g) were added. Exactly 500ml of water was added to the contents in the pot and boiled for 10 minutes, after which 50g of dried fish was added and further boiled for another 5 minutes. The fish was removed and 50g of okra powder was added slowly with constant smoothening with cooking broom. Additional 150ml of distilled water was further added to the soup, the fish was returned to the pot and boiled for another 5 minutes. The pot was put down from the stove, cooled, the pot and its contents were weighed to determine the yield (NFSMI, 2010) (Table 3).

2.6.3. "Eni Kpanmi" (Fresh Okra Soup)

A pre-weighed aluminum pot was put on a stove to allow the pot to dry. Then 25g of palm oil was added and allows to be heated for 2 minutes. Exactly 14g of fresh pounded pepper was added to the oil and then 15g of "kula tsaka" (Locust bean), maggi (12g), and salt (3g) were added. Accurately 250 ml of water and 1.4g potash were added to the contents in the pot and boiled for 7 minutes, after which 100g of fresh sliced okra was added and 50g of dried fish was also added and further boiled for another 5 minutes. Additional 100 ml of water was further added to the soup and boiled for another 3 minutes. The pot was put down, cooled, the pot and its contents weighed to determine the yield (NFSMI, 2010) (Table 4).

2.6.4. "Eni Nungbere" (Custard Apple Calyx Soup)

A pre-weighed aluminum pot was put on a stove to allow the pot to dry and then 100g of palm oil was added and allows to be heated for 2 minutes. Accurately 14g of fresh pounded pepper with 20g of onion was added to the oil. Then 15g of "kula tsaka" (Locust bean), maggi (12g), and salt (3g) were added. Exactly 400ml of water was added to the contents in the pot and boiled for 10 minutes, after which 50g of fish was added and further boiled for another 5 minutes. The fish was removed and 50g of "Nungbere" powder was added slowly with constant smoothening with cooking broom. Additional 250ml of water was further added to the soup and the fish was returned and boiled for another 5 minutes. The pot was put down, cooled, the pot and its contents was weighed to determine the yield (NFSMI, 2010) (Table 5).

2.6.5. "Eni Emagi" (Roselle/Sorrel Calyx Soup)

A pre-weighed aluminum pot was put on a stove to allow the pot to dry and then 50g of palm oil was added and allows to be heated for 2 minutes. Exactly 14g of fresh pounded pepper with 20g of onion was added to the oil, then 15g of "kula tsaka" (Locust bean), maggi (12g), salt (3g) and 25g of grounded melon were added. Moreso, 500ml of water was added to the contents in the pot and boiled for 10 minutes, thereafter, 50g of

dried fish was added and then further boiled for another 5 minutes. Exactly 160g "emagi" (green sorrel calyx) was added to the soup contents and additional 150 ml of water was further added to the soup and boiled for another 5 minutes. The pot was put down, cooled, the pot and its contents was weighed to determine the yield (NFSMI, 2010) (Table 6).

2.6.6. "Eni Ezowa" (Beans Soup)

A pre-weighed aluminum pot was put on a kerosene stove and exactly 500 ml of water was added to the pot. Then 148g of uncoated beans seed with 2g of potash was added to the pot. The contents were allowed to boil for 30 minutes after which, 14g of fresh pounded pepper with 20g of onion, palm oil (50g) were added and boiled for further 10 minutes. Then 15g of "kula tsaka" (Locust bean), maggi (12g), salt (3g) and 50g of dried fish were added and allowed to boil for another 15 minutes. The fish was removed and the bean seeds were smoothening with cooking broom. The fish was then returned and additional 85ml of water was added and the contents were allowed to boil for another 5 minutes. The pot was put down, cooled, the pot and its contents was weighed to determine the yield (NFSMI, 2010) (Table 7).

Table 2. *Ingredients for Preparation of Kuka Soup (Eni Kuka).*

English Name	Nupe Name	Weight/Volume used	Measurement
Baobab leaves Powder	Kuka	50g	1 small tin cup of milk
Dry fish without bone or head	Ikan	50g	2 medium size
Palm Oil	Emi dzuru	50g	1 small tin cup of tomato
Pepper (Fresh)	Rudu	14g	4 pieces
Onion	Lubasa	20g	1 small size bulb
Maggi star	Maaggi	12g	3 cubes
Locust beans	Kula tsaka	15g	4 pieces (mold)
Salt	Esan	3g	½ Small teaspoon
Water	Nuwa	700ml	2 small cup
Average Yield		638.33g	

Table 3. *Ingredients for Preparation Okra Soup (Powder) (Eni Tsuku).*

English Name	Nupe Name	Weight/Volume Used	Measurement
Okra Powder	Tsuku	50g	1 small tin cup of milk
Dry fish without bone or head	Ikan	50g	2 medium size
Palm Oil	Emi dzuru	50g	1 small tin cup of tomato
Pepper (Fresh)	Rudu	14g	4 pieces
Onion	Lubasa	20g	1 small size bulb
Maggi star	Maaggi	12g	3 cubes
Locust beans	Kula tsaka	15g	4 pieces (mold)
Salt	Esan	3g	½ Small teaspoon
Water	Nuwa	650ml	2 small cup
Average Yield		650.00g	

Table 4. *Ingredients for Preparation of Fresh Okra Soup (Eni Kpanmi).*

English Name	Nupe Name	Weight/Volume Used	Measurement
Fresh Okra	Kpanmi	100g	30 pieces
Dry fish without bone or head	Ikan	50g	2 medium size
Palm Oil	Emi dzuru	25g	½ small cup of tomato
Pepper (Fresh)	Rudu	14g	4 pieces
Potash	Kanwa	1.4g	4 small pieces
Maggi star	Maaggi	12g	3 cubes
Locust beans	Kula tsaka	15g	4 pieces (mold)
Salt	Esan	3g	½ Small teaspoon
Water	Nuwa	350ml	1 small cup
Average Yield		466.67g	

Table 5. *Ingredients for Preparation of Nungbere Soup (Eni Nungbere).*

English Name	Nupe Name	Weight/Volume Used	Measurement
Nungbere Powder	Nungbere	50g	1 small tin cup of milk
Dry fish without bone or head	Ikan	50g	2 medium size
Palm Oil	Emi dzuru	100g	2 small tin cup of tomato
Pepper (Fresh)	Rudu	14g	4 pieces
Onion	Lubasa	20g	1 small size bulb
Maggi star	Maaggi	12g	3 cubes
Locust beans	Kula tsaka	15g	4 pieces (mold)
Salt	Esan	3g	½ teaspoon
Water	Nuwa	650ml	2 small cup
Average Yield		733.33g	

Table 6. *Ingredients for Preparation of Green Calyx Roselle (Eni Emagi).*

English Name	Nupe Name	Weight/Volume Used	Measurement
Green Calyx Roselle	Emagi	160g	½ mudu
Dry fish without bone or head	Ikan	50g	2 medium size
Palm Oil	Emi dzuru	50g	1 small tin cup of tomato
Pepper (Fresh)	Rudu	14g	4 pieces
Onion	Lubasa	20g	1 small size bulb
Maggi star	Maaggi	12g	3 cubes
Locust beans	Kula tsaka	15g	4 pieces (mold)
Melon (Grounded)	Egusi	25g	2 spoonful
Salt	Esan	3g	½ teaspoon
Water	Nuwa	650ml	2 small cup
Average Yield		850.00g	

Table 7. *Ingredients for Preparation of Beans Soup (Eni Ezowa).*

English Name	Nupe Name	Weight/Volume Used	Measurement
Bean seeds	Ezowa	148g	1 small tin cup of milk
Dry fish without bone or head	Ikan	50g	2 medium size
Palm Oil	Emi dzuru	50g	1 small cup of tomato
Pepper (Fresh)	Rudu	14g	4 pieces
Onion	Lubasa	20g	1 small size bulb
Maggi star	Maaggi	12g	3 cubes
Locust beans	Kula tsaka	15g	4 pieces (mold)
Salt	Esan	3g	½ teaspoon
Water	Nuwa	585ml	1 ½ small cup
Average Yield		766.67g	

3. Sample Preparation

The prepared standardized soups were homogenized with the use of laboratory blender (Waring commercial HGBTWTS3). Five grams (5g) of each sample was used to determine the actual moisture at 100°C, while the rest sample was dried at 60°C in an oven drier (DHG 9202, Drying oven), then packaged in an air-tight container and stored in the freezer until ready for nutrient analysis.

3.1. Nutrient Analysis

3.1.1. Water Conversion Factor (WCF)

Water Conversion Factor (WCF) method was used for the soup samples as described [31].

$$\text{WCF} = \frac{100 - \text{Actual moisture}}{100 - \text{Residual moisture}}$$

The values obtained through chemical analysis were multiplied with the WCF to obtain nutrient contents of the recipes as consumed.

3.1.2. Mineral Analysis

Mineral elements were determined according to method described in AOAC [15]. Exactly 1.0g of each sample was ash in a muffle furnace (SXL-1008) at 550°C. The ashes of various samples were dissolved in 10ml of 0.1M HCl, filtered and made up with distilled water to the mark in a 100ml volumetric flask. The seven (7) elements determined were Mg, Ca, Zn, Fe, Cu, Na and K using Atomic Absorption Spectrophotometer (AAS) (AA500 spectrophotometer, Pg Instrument).

3.2. Determination of β-Carotene

Method of Musa *et al.,* [16] was used to evaluate the β-carotene of the soup samples. Exactly 2.0g of Na_2SO_4 was added to 10g of the soup samples and homogenized. The homogenized sample was extracted with 100ml of hot 95% ethanol for 30 minutes in hot water bath. The extract obtained was filtered, measured and distilled water was added to the extract to bring the percentage of the ethanol extract to 85%; then cooled in a cold water bath for 10 minutes. After cooling, the ethanol extract was transferred to separating funnel with 30ml of petroleum ether added and the mixture shaken. The separating funnel was clamped to the retort stand and the mixture was allowed to settle down into layers. The bottom layer containing the ethanol was collected into a beaker while the top layer (petroleum layer) was stored in 250ml conical flask. The ethanol layer in the beaker was re-extracted twice with 10ml of petroleum ether. The ether layers of re-extraction were added to the original petroleum extract in the conical flask and re-extracted with 50ml of 85% ethanol in order to remove any xanthophyll which may be present. The top petroleum ether layer which contained the β–carotene was collected, measured and volume recorded. The absorbance of the final petroleum ether extract was determined at the wavelength of 450nm with spectrophotometer (UV 3100 PC) using petroleum ether as the blank.

Calculation: The concentration of β–carotene was calculated thus:

$$A = \varepsilon^{\%} \times C \times l$$

Where A = Absorbance of the sample
C = Concentration

$\varepsilon^{\%}$ = Extinction coefficient of β-carotene at 450nm
l = Path length

3.3. Vitamin B Analysis

Vitamin B analysis of the soup samples were carried out using the method of Augustin *et al.,* [17]. The various concentration of standard vitamin B complex (B1, B2 and B3) was prepared into 10 ml volumetric flask. Exactly 5 ml of mix buffer was added, shaken for 2 minutes and make up to the volume. Then 5 ml and 2.5 ml of the stock solutions were measured into different 10 ml capacity volumetric flasks and made up to the mark. This was then stored at 4°C, the solution was filtered and each calibrate was injected twice into HPLC.

Similarly, the soup sample was homogenized using mixer blender and exactly 2.5g of the sample was weighed and transferred into a 10 ml volumetric flask. Then 5ml of the mix buffer was added and shaken for 5 minutes using mechanical shaker or sonnicator, the flask was made up to the mark. The filtered sample was injected into HPLC and the vitamin concentration was estimated using the calibration curve. Chromatographic analysis was carried out isocratically using:

Wavelength: 275nm
Column: Reversed phase C18, 5pm ODS2, 4.6 x 250mm
Flow rate: 1.5 ml/minute
Mobile phase: 300 ml methanol in 700 ml buffer (30% Methanol: 70% Buffer)
Calculations:

$$\text{Concentration (mg/l)} = \frac{\text{mm/ml (from calibration curve) x 1000 x dilution factor}}{\text{Sample weight}}$$

3.4. Vitamin C

The vitamin C content of the sample was determined as described [18]. Exactly 0.05g (50mg) of 2, 6-dichloroindophenol dye was dissolved in distilled water and make up to 100ml then filtered. Also, 0.05g of pure ascorbic acid standard was dissolved in 60ml of 20% glacial acetic acid and diluted to 250ml using distilled water. Then 10ml of standard ascorbic acid was pipetted into a conical flask and titrated with the dye solution until a faint pink colour persisted for 15 second. The concentration was expressed as mg ascorbic acid equivalent to 1ml of the dye solution.

Similarly, accurately ten grams (10g) of the soup sample was homogenized with 100ml of glacial acetic acid. The suspension was filtered through a Whatman filter paper No. 1 and 10ml of the filtrate was pipetted into a conical flask containing 2.5ml acetone and titrated with the dye solution until a faint pink colour persisted for 15 seconds.

Ascorbic acid was calculated as mg per 100g food sample as

Vitamin C (mg/100g) = Titre x N x dilution factor

N = mg ascorbic acid standard equivalent to 1ml dye solution.

4. Results

The results of mineral and vitamin compositions of the standardized Nupe soups are presented in the tables below.

Table 8. *Mineral Compositions of Standardized Commonly Consumed Native Soups among Nupe People of Niger State (mg/100g as consumed).*

Soups	Ca	Mg	Zn	Fe	Cu	K	Na
"Eni Emagi" (Roselle soup)	0.042±0.08^{a}	0.032±0.06^{a}	0.043±0.05^{bc}	0.022±0.05^{a}	0.022±0.04^{a}	0.022±0.01^{a}	0.026±0.02^{a}
"Eni Kuka" (Baobab soup)	0.042±0.13^{a}	0.037±0.06^{ab}	0.028±0.07^{ab}	0.017±0.07^{a}	0.028±0.07^{a}	0.033±0.01^{b}	0.031±0.04^{a}
"Eni Nungbere" (African custard apple soup)	0.035±0.13^{a}	0.037±0.03^{ab}	0.051±0.05^{c}	0.019±0.03^{a}	0.027±0.00^{a}	0.036±0.06^{b}	0.039±0.02^{b}
"Eni Tsuku" (Okra, power soup)	0.040±0.12^{a}	0.047±0.03^{b}	0.025±0.05^{a}	0.029±0.00^{b}	0.039±0.18^{a}	0.043±0.03^{c}	0.044±0.02^{b}
"Eni Kpanmi" (Okra, fresh soup)	0.027±0.08^{a}	0.063±0.10^{c}	0.016±0.05^{a}	0.038±0.05^{c}	0.025±0.02^{a}	0.049±0.01^{d}	0.052±0.04^{c}
"Eni Ezowa"(Bean soup)	0.035±0.27^{a}	0.093±0.12^{d}	0.021±0.17^{a}	0.041±0.03^{c}	0.026±0.09^{a}	0.055±0.02^{e}	0.059±0.04^{d}

Values are Mean ± S.D of triplicate determinations.
Values with different superscripts down the column are significantly different ($p<0.05$).
Ca: Calcium; Mg: Magnesium; Zn: Zinc; Fe: Iron; Cu: Copper; K: Potassium; Na: Sodium

4.1. Mineral Compositions of Standardized Native Soups of Nupe People in Niger State

Table 8 shows the mineral composition of Nupe soups; the result indicates that both "Eni emagi" and "Eni Kuka" have the same concentration each for calcium (0.042mg/100g) while "Eni Kpanmi" had the lowest content (0.027 mg/100g). There was no significant difference ($p>0.05$) in the concentration of each soup samples. Magnesium concentration ranged from 0.032 to 0.093 mg/100g, with "Eni ezowa" (0.093 mg/100g) having the highest content while "Eni emagi" (0.032 mg/100g) had the lowest concentration. "Eni emagi" (0.043 mg/100g) was highest for zinc contents and "Eni kpanmi" (0.016 mg/100g) recorded the lowest concentration. There was significant difference ($p<0.05$) in the value of "Eni emagi" compared to other soups. "Eni ezowa" (0.041±0.03 mg/100g) had the highest contents for iron, followed by "Eni kpanmi" (0.038±0.05 mg/100g) and "Eni kuka" (0.017±0.07) had the least content. There was significant difference ($p<0.05$) in iron contents between "Eni ezowa" and "Eni kuka". The table also revealed that the concentration of copper ranges between 0.022 to 0.039 mg/100g, "Eni Tsuku" (0.039±0.18 mg/100g) recorded the highest concentration while "Eni emagi" (0.022±0.04 mg/100g) had the lowest amount. Copper concentration of each soup does not significantly differ

(p>0.05) from each other. Potassium concentration of the soups increases along the column from 0.022 mg/100g in "Eni emagi" to 0.055 mg/100g in "Eni ezowa" while the same trend was observed for sodium contents of all the soups. "Eni emagi" (0.026 mg/100g) had the least contents of sodium whereas "Eni ezowa" recorded the highest concentration (0.059 mg/100g). The sodium content of "Eni ezowa" was significantly different (p<0.05) when compared to other standardized soups.

4.2. Vitamins Composition of Standardized Commonly Consumed Native Soups Among Nupe People of Niger State

Table 9 shows the vitamin compositions of the standardized native soups. β-carotene (pro-vitamin A) content indicates that "Eni kuka" had the highest concentration (0.06±004 mg/100g) while "Eni kpanmi" had the lowest value (0.01±0.01 mg/100g as consumed). There was significant (p<0.05) difference in the β-carotene concentration of "Eni kuka" when compared to the other soups. Vitamin B1 concentration ranged from 10.45±0.78 – 17.89±2.53 mg/100g, "Eni emagi" (10.45±0.78 mg/100g) and "Eni ezowa" (17.89±2.53 mg/100g) had the lowest and highest concentrations respectively. The concentration of "Eni ezowa" for vitamin B1 was significantly (p<0.05) different when compared to other standardized soups except in "eni kuka". "Eni ezowa" was found to have the highest concentration of vitamin B2 (12.23±1.86 mg/100g), followed by "eni tsuku" (10.14±1.57 mg/100g) while "eni nungbere" recorded the lowest value of vitamin B2 content (0.08±0.02 mg/100g). There was no significant (p>0.05) difference in vitamin B2 values between "eni ezowa" and "eni tsuku" and vitamin B2 was not detected in "Eni kpanmi". Vitamin B3 concentration of the soups revealed that "Eni kuka" recorded the highest mean (0.21±0.02 mg/100g) and "Eni nungbere" had the lowest content (0.02±0.01 mg/100g). "Eni kuka" concentration was significantly (p<0.05) higher than the other soups. Vitamin C contents ranged from 0.20±0.02 to 0.44±0.04 mg/100g. "Eni kuka" had the highest concentration (0.44±0.04 mg/100g) while "Eni emagi" had the lowest content (0.20±0.02 mg/100g). There was significant (p<0.05) difference in the concentration of vitamin C in "Eni kuka" and "Eni emagi" compared to the other soups.

Table 9. *Vitamin Compositions of Standardized Commonly Consumed Native Soups among Nupe People of Niger State (mg/100g as Consumed).*

Soup	β-carotene	Vitamin B1	Vitamin B2	Vitamin B3	Vitamin C
"Eni Kuka" (Baobab soup)	0.06^{b}±0.04	16.79^{c} ±1.86	3.29^{b}±1.64	0.21^{c}±0.02	0.44^{c} ±0.04
"Eni Nungbere" (African custard apple soup)	0.03^{ab}±0.01	13.76^{b} ±0.83	0.08^{a}±0.02	0.02^{a}±0.01	0.24^{ab} ±0.05
"Eni Tsuku" (Okra, power soup)	0.02^{a}±0.01	13.34^{b} ±1.28	10.14^{c}±1.57	0.09^{b}±0.01	0.26^{ab} ±0.03
"Eni Ezowa" (Beans soup)	0.04^{ab}±0.01	17.89^{c} ±2.53	12.23^{c}±1.86	0.06^{ab}±0.01	0.28^{b} ±0.05
"Eni Emagi" (Roselle soup)	0.04^{ab}±0.01	10.45^{a} ±0.78	3.78^{b}±1.06	0.11^{b}±0.02	0.20^{a} ±0.02
"Eni Kpanmi" (Okra, fresh soup)	0.01^{a}±0.01	12.45^{ab}±0.35	ND	0.12^{b}±0.07	0.23^{ab} ±0.01

Values are Mean ±S.D triplicate determinations. Values with different superscripts down the column are significantly different (p<0.05). N.D – Not Detected

5. Discussion

The calcium content of the soups in this present study was lower than the value reported [19], that the vegetable soups had values between 0.08 – 0.12 mg/100g. However, large quantities of the vegetables need to be added in the preparation of the soups so as to increase the quantity of the mineral that would be available and absorb by the body. Calcium is important for bone and teeth development in children and adult. Nerve impulse transmission, muscle action such as heartbeat, blood clotting, cell membrane integrity, intracellular communication and cofactor are important functions of calcium in the body [20]. Calcium deficiency may lead to osteoporosis - bone disease degenerative that may strike older individuals without warning [20].

Magnesium is important in calcium metabolism in bones. It prevents circulatory diseases, helps in blood pressure regulation and insulin release [21, 22]. Magnesium concentration reported for small white bean (SWB) was 0.72 ppm and "Eni ezowa" a bean soup had the highest concentration of magnesium amongst other soups analyzed which was higher than that reported by Ape *et al.* [23]. Deficiency in magnesium may cause reduction in cell formation and dietary allowance of magnesium in adults was 0.35 – 0.45ppm per day.

The concentration of zinc obtained in this study shows that "eni kpanmi" had the lowest value while "eni nungbere" had the highest. Zinc is vital for protein synthesis, cellular differentiation and replication, strengthen immunity and sexual functions. Iron and zinc contents of the soups in this present study are lower than the values reported [24, 25]. Iron is an essential component of haemoglobin and the form of iron in plant sources is non-heme iron. Enough haemoglobin cannot be synthesized for newly formed red blood cells when iron reserves in the body are low [20]. Diets that can supplies sufficient quantities of the iron must be provided to women and children so as to prevent iron deficiency. Iron deficiency anaemia causes fatigue, inability to concentrate, pale colouration, weakness and restlessness.

"Eni tsuku" had the highest concentration of copper than the other soups, which suggests that it may be a good source of copper. Several enzymes needed for proper metabolism has copper as its component. Copper aids iron metabolism and is an integral part of ceruloplasmin that converts ferrous to ferric prior to its transportation via transferrin [20]. Copper deficiency could lead to anaemia, impaired immunity and bone diseases. Excess copper and zinc can produce a deficiency of the other as they compete for gastrointestinal

transport with each other [20].

The potassium value obtained for "Eni ezowa" (bean soup) is far lower when compared to that reported in some Nigerian soups [8, 25]. Potassium is a principal cation of intra-cellular fluids; maintain electrolyte balance in the body, contraction of muscle and transduction of nerve-signal. Potassium influences glucose and lipid metabolism. Increase in the intake of potassium lower blood pressure and may also prevent strokes. However, heart failure and death may result from excess intake of potassium (hyperkalamia).

The sodium content of the soups showed that "eni ezowa" had the highest concentration as observed for potassium. This concentration is also far lower than those reported in some Nigerian indigenous soups [8, 25]. Deficiency in sodium might lead to some health problem, which may prevent the element from performing the function of maintaining acid-base and fluid balances, heartbeat, nerve impulse transmission and cell permeability in the body [26, 27]. However, low sodium content in food is good for hypertensive patient and excess intake could cause hypertension and heart failure [26] due to high fluid retention.

Vitamins are important in our diet as they play many roles in the normal cell functioning. The β-carotene (a precursor of vitamin A) is a powerful antioxidant, which protect the cells from damage cause by free radicals and it enhances the function of immune system [20, 28, 29]. "Eni kuka" had the highest concentration of β-carotene amongst the soups but this value is far lower than the concentration of "kuka" soup reported [30]. Inadequate intake of vitamin A or its precursor can lead to deficiency of vitamin A like night blindness, incidence of cancer and other infectious diseases [20, 28].

Thiamine (vitamin B1) content of the soups indicates that "eni ezowa" (beans soup) had the highest concentration, suggested that it could be a better source of B1 when compared to other soups analyzed. The value obtained in this study was higher than the concentration of the vitamins B1 reported [31]. Vitamin B1 is a co-enzyme in thiamine pyrophosphate, involved in metabolic breakdown of carbohydrates [20]. Deficiency of vitamin B1 causes beriberi and the symptoms may include: fatigue; depression; mental confusion; cramping; enlarge heart and eventually death from cardiac failure [20]. Good dietary sources of this vitamin such as meat may be included in the preparation of the soups in order to have adequate amount of the vitamin.

The vitamin B2 (Riboflavin) content of the soups also showed that "eni ezowa" may be a rich source of this vitamin when compared to the other soups. The concentration of vitamin B2 of the soup in this study was higher than the value reported [31]. The vitamin B2 content of the soup can meet up with the recommended daily allowance of 1.7mg/day. Beans soup (eni ezowa), which is a good source of vitamin B2 may help to convert carbohydrates into adenosine triphosphate (ATP) and ATP is vital for storing energy in muscles.

Vitamin B3 (Niacin) is an important co-enzyme in oxidation-reduction reactions of many energy-yielding metabolic pathways. The vitamin B3 contents in the soups indicate that "kuka" soup had the highest concentration, which is higher than those reported in earlier study [31]. Foods rich in the essential amino (tryptophan) can supplied vitamin B3 because the body can synthesize niacin from amino acids [20]. Vitamin B3 deficiency, coupled with a low-protein diet result into severe deficiency disease, known as pellagra [20].

The vitamin C content of the soups revealed that "eni kuka" had the highest concentration which is lower than those reported by other researchers [25]. Sundarambal *et al.* [32] reported that the natural vitamin C content of *Adansonia digitata* (kuka) enhances its high antioxidant activity. Vitamin C is a potential antioxidant, which protects the cell membrane from oxidative stress/damage caused by free radical [33]. Vitamin C antioxidant property is required for maintaining normal connective tissues, healing of wound and also facilitated absorption of dietary iron from the intestine [20, 34]. Adequate intake of this vegetable (kuka) may prevent disease conditions connected with deficiency of this important vitamin.

6. Conclusion

The Nupe commonly consumed soups were documented through the use of questionnanire. The soups were standardized, prepared in the laboratory and analyzed for micronutrients. The finding shows that the soups contain appreciable amount of minerals and adequate amount of vitamins B1 and B2, which could help to meet up with the recommended daily intake of the B vitamins. This finding also contributes data to Nigeria food composition table.

Conflict of Interest

All the authors do not have any possible conflicts of interest.

References

[1] Izah S. C, Inyang I. R., Angaye T. C. N., and Okowa I. P (2017). A review of heavy metal concentration and potential health implications in beverages consumed in Nigeria. *Toxics* 5 (1): 1-15.

[2] Kaefar, C. M and Millne, J. A. (2008). The role of herbs and spices in cancer prevention. *Journal of Nutritional Biochemistry*, 19 (6), 347 – 361.

[3] Ertan, P., Yereli, K., Kurt, O., Balcioglu, I. C. and Onag, A. (2002). Serological levels of zinc, copper and iron element among *Giadialamblia* injected children in Turkey. *Pediatrics International*, 44: 286-288.

[4] Falade, O. S., Sowunmi, O. R, Oladipo, A., Tubosun, A. and Adewusi, S. R. A. (2003). The level of organic acids in some Nigerian fruits and their effects on mineral availability in composite diets. *Pakistan Journal of Nutrition*, 2: 82-88.

[5] Black, R. (2003). Micronutrient deficiency-an underlying cause of morbidity and mortality. *Bulletin of World Health Organization*, 81: 79-83.

[6] Barminas, J. T., Charles, M. and Emmanuel, D. (1998). Mineral composition of non-conventional leafy vegetables. *Plant Foods for Human Nutrition*, 53: 29-36.

[7] FAO (2013). State of Food and Agriculture, In: Sustainable Development Goals – Hidden hunger, Rome.

[8] Kayode, O. F., Ozumba, A. U., Ojeniyi, S., Adetuyi, D. O., and Erukainure, O. L. (2010). Micronutrient content of selected indigenous soups in Nigeria. *Pakistan Journal of Nutrition,* Vol. 9 (10): 962 – 965.

[9] Mepba, H. D., Eboh, L. and Banigo, D. E. B. (2007). Effects of processing treatments the nutritive composition and consumer acceptance of some Nigerian edible leafy vegetables. *African Journal of Food, Agriculture, Nutrition and Development*, 7: 1–18.

[10] Hart, A. D, Azubuike, C. U, Barimalaa, I. S and Achinewhu, S C. (2005). Vegetable consumption pattern of households in selected areas of the old Rivers State in Nigeria. *African Journal of Food, Agriculture, Nutrition and Development,* 5, 1–19.

[11] Fayeme, P. O. (1999). *Nigerian Vegetables*. Ibadan, Nigeria; Longman Educational Books. Pp. 1-7.

[12] Thompson H. C and Kelly W. C. (1990). *Vegetable Crops*. 5th Eds. New Delhi: Mac GrawHill Publishing Company Ltd. 120-125.

[13] National Food Service Management Institute (2010). Measuring success with Standardized Recipes. Available from http://www.nfsmi.org/resoucesoverview.aspx?ID=88. Retrieved: 10.09.10.

[14] Usman, A. A. (2017). *Nupe and their historical links*. Publish by Niger Printing and Publishing Company. Available on www.newsline.org.ng.

[15] AOAC (Association of official analytical chemistry) (2000). Official method of Analysis. Washington DC.

[16] Musa, A., Ezenwa, M. I. S., Oladiran, J. A., Akanya, H. O. and Ogbadoyi, E. O (2010). Effect of soil nitrogen levels on some micronutrients, anti-nutrients and toxic substances in *Corchorus olitorius* grown in Minna, Nigeria. *African Journal of Agricultural Resources*, 5 (22): 3075-3081.

[17] Augustin, J., Klein, B. P., Becker, D., and Venugopal, P. B. (1985). Simultaneous Analysis of B-complexes in Chromatographic assay of Vitamin, 4thed, Methods of Vitamin Assay, John Wily & Sons, New York, p87.

[18] AOAC. (2005). (Association of Official Analytical Chemistry) Official Methods of analysis, Washington DC.

[19] Oguche Gladys, H. E (2012). The effect of sun and shade drying on chemical composition of *Vitex doniana*, *Ipomoea aquatic* and *Cohcorus* and their soups. *International Journal of Nutrition and Metabolism*, 4 (9): 121 – 129.

[20] Levetin-McMahon (2008). *Plant and Society*: Plants as a source of food. Human Nutrition. 5th (ed), The McGraw Hill companies, pp. 160-161.

[21] Onyiriuka, S. O.; Nwadinigwe, C. A.; Nwaji, M. N, Akpansi, L. E. S and Okoro, U. C, (1997). *Principles of organic chemistry*. (1st edition); 12: 206-209.

[22] Umar, K. J.; Hassan, L. G and Garba H. J. (2005). Proximate and mineral composition of *M. miristica*. *Chemclass Journal* 3: 81-84.

[23] Ape D. I, Nwogu N. A, Nwafor E. C and Umoren C. N (2015). Comparative Proximate and Elemental Analysis of Four Species of Cowpea Beans Seed Coat (*Vigna Ungucuilata*) in Enugu State Nigeria. *International Journal of Basic and Applied Science,* 4 (2): 1-8.

[24] Ene-Obong, H. N. and Carnovale (1992). A comparison of the proximate, mineral and amino acid compositions of some known and lesser-known legumes in Nigeria. *Food Chemistry,* 43, 169-175.

[25] Obiakor–Okeke, P. N., Obioha., B. C., andOnyeneke, E. N. (2014). Nutrient and Sensory Evaluation of Traditional Soups Consumed in Igbere Community in Bende Local Government Area, Abia State, Nigeria. *International Journal of Nutrition and Food Sciences;* 3 (5): 370-379. doi: 10.11648/j.ijnfs.20140305.12.

[26] Aremu, M. O., Olaofe, O. and Akintayo, E. T. (2006). Mineral and amino acid composition of two varieties ofBambara groundnut (*Vigna subterranean*) andKersting groundnut (*Kershigiellageocarpa*) flours. *International Journal of Chemistry*, 16: 57-64.

[27] Satyanarayana, U and Chakrapani, U. (2009). *Essential Biochemistry*. 2nd edition, Book and Allied (P) Ltd. Beliaghata Main Road, Kolkata, India, 210-224.

[28] George, D. P. R (1999). *New life style: Enjoy it*. Editorial Safeliz, Spain, 39, 65-100.

[29] Musa, A. and Ogbadoyi, E. O. (2012). Effect of plant leaf positions on some micronutrients, anti-nutrients and toxic substances in *Telfairia occidentalis* at vegetative phase. *American Journal of Experimental Agriculture,* 2 (2): 219-232.

[30] Sanusi, R. A. and Adebiyi, E. A. (2009). Beta carotene content of commonly consumed foods and soups in Nigeria. *Pakistan Journal of Nutrition,* 8 (9): 1512-1516.

[31] Davidson, G. I, Ene-Obong, H. N. and Chinma, C. E (2017). Variations in Nutrients Composition of Most Commonly Consumed Cassava (*Manihotesculenta*) Mixed Dishes in South-east Nigeria. *Journal of Food Quality*, 1: 1-15, doi.org.10.1155/2017/6390592.

[32] Sundarambal M., Muthusamy P., Radha R., and Jeral Suresh A. (2015). A Review on *Adansonia digitata Linn*. *Journal of Pharmacognosy and Phytochemistry,* 4 (4): 12–16. www.phytojournal.com.

[33] Guyton, C and Hall, J. E (2006). *Textbook of Medical Physiology*. Elseveir publisher, Philadelphia, India; 11: 113-115.

[34] Button, K. C (2004). *Prescription for nutritional healing*. Penguin Putnam, 4 (5): 478-479.