Impact of Indigenous Methods of Preparation and Cooking on the Proximate, Mineral, Vitamins, Amino and Fatty Acids Compositions of Groundnut Soups Prepared in Cross River State, Nigeria

Stella Bassey Lilian Aburime Winifred, Fila Ako, R Odey, C Odey F
Department of Biochemistry (Human Nutrition and Dietetics Unit), Faculty of Basic Medical Sciences, Calabar

Abstract
Impact of variable standard preparation methods on the proximate, vitamins, fatty acids, minerals and amino acids compositions of groundnut soups were assessed using standard methods. Toasted groundnut soups (TGS) and raw groundnut soups (RGS) were rich in arginine (2.19 ± 0.00 % and 3.57 ±0.00 %) and leucine (1.37 ± 0.00 % and 2.80 ±0.00 %) respectively. TGS had significantly ($p<0.05$) higher Phosphorus 51±0.12; Potassium 186 ±0.41; Magnesium 18 ±4.10; Calcium 45 ±1.21 and Sodium. Cupper, iron and Zinc were comparable in both soups. The soups were rich in fatty acids, oleic, linoleic and palmitic acids. The protein content of RGS (10.9 ±0.08 %) and TGS (10.1 ±0.04 %) were not comparable ($P>0.05$). The soups were rich in dietary fibre, fats and energy. RGS had higher α-carotenoids, β-carotenoids, β-cryptoxanthin and vitamin A contents. The soups have variable but rich nutrients needed for optimal body function.
Keywords: Groundnuts, soups, amino acid, fatty acid, proximate mineral
DOI: 10.7176/FSQM/102-05
Publication date: November 30th 2020

INTRODUCTION

The relationship between food and nutrition is essential to having a healthy population that can promote development. In Nigeria, most people eat soup based foods at least once daily, it is imperative to exploit the available local food resources, in order to satisfy the need of the increasing population (Aburime *et al*., 2020). Soup is a liquid food usually savory made by stewing ingredient such as meat, fish or game, often in a stock and with seasoning or chemical mixture (Kayode *et al*., 2010; Kayode & Kayode, 2011). Soup is an important type of food delicacy in the world. It is enjoyed by both the rich and the poor. The nutritional value of a particular soup type depends on its ingredients which are also determined by the financial strength of the person. There are various types of soups, which are peculiar to different tribes. These soups are made with different ingredients alongside nutritionally important indigenous tropical seeds like *egusi'* (*Citrullus vulgaris*) and groundnut seed (*Arachea hypogea*) among others that are highly cherished and usually used in the preparation of soups in Cross River State are melon (Bassy *et al.,* 2020). These seeds have nutritive and calorific values, which make them necessary in diets, (USDA, 2017). Groundnuts (*Arachis hypogaea*) or peanut is a legume which is widely grown as a food crop. Groundnut is an important source of edible oil for millions of people living in the tropics. In Nigeria, tons of groundnut seeds are being produced annually (Ergul, 2018). Groundnuts are among the oldest oil crops in Nigeria and are mostly consumed as Snacks, after roasting or boiling (Bansal *et al*., 2012; Jambunathan *et al.,* 2015). Groundnut seeds contains 44 to 56% oil and 22 to 30% protein on a dry weight basis and is a rich source of minerals (Phosphorus, Calcium, Magnesium and pottasium) and vitamins (E, K and B group) (Savage & Keenan, 2014). Groundnut protein is increasingly becoming important, especially in developing countries where protein of animal sources are not within the means of the majority of the populace. They have several uses as whole seed or in processed form as seen in peanut butter, popular groundnut oil in Nigeria, condiments, spreads, soups, stews and other products. Groundnut soup is popular among the people of northern Cross River State (Obudu, Ogoja, Bekwarra, Obanliku and Yala). The soup is prepared from blended groundnut seeds, the typical ingredients used in the preparation of this soup (apart from the seed, water and oil) may include vegetables such as bitter leaf, hot leaf (uziza) pumpkin (ugu), beef, goat meat, fish, crayfish, *dawadawa* (locust beans) and other seasonings. This soup is usually eaten with swallows such as pounded yam, 'foofoo', garri and other flours made into stiff porridge. Nigeria is a multi-cultural society with different traditional soups which are indigenous to them but malnutrition still abounds especially among the rural populace, and worse in pregnant women and children (FAO, 2012, Reeds *et al.,* 2016, FAO, IFAD, UNICEF, WFP & WHO, 2018). With the variations in ingredients and different cooking methods, it is unknown if these soups have needed nutrients for optimal health and also, with the paucity in scientific literature on the nutritional value of locally consumed soups, there is need for a more complete, accurate and reliable data on the nutrient composition and nutritional value of indigenous soups. However, the nutritional value of a soups varies depending on the ingredients used, cooking temperature and the method of preparations. This study therefore aims at comparing nutritional composition of groundnut soups prepared using different indigenous methods consumed locally in Nigeria. This is to promote consumption of soups which are naturally rich in micronutrient within different ethnic groups so as to reduce occurrences of some micro and macro nutrient deficiencies.

Materials and methods

2.1 Sample collection

Groundnut seed (*Arachis hypogea*), hot leaf, beef, fish (dried), stock-fish, crayfish, salt, bouillon cube, palm oil, pepper, locust beans (*dawadawa*) and onions were purchased from Wattt market in Calabar South Local Government Area of Cross River State, Nigeria in the month of October.

2.2 Method of preparation of groundnut soups (Obudu and Ogoja).

The soups were prepared using the standardized methods as described by Bassey *et al.* (2020).

Method of preparation of groundnut soup. (Soup 1: Obudu).

Table 1: Soup ingredients and quantity for groundnut soups 1 and 2

Ingredients	Soup 1 (Obudu)	Soup 2 (Ogoja)
Groundnut	338g	338g
Meat	500g	500g
Dry fish	350g	350g
Stock fish	380g	380g
Crayfish	50g	50g
Pepper	13g	13g
Salt	11g	11g
Bouillon cube	16g	16g
Locust bean	42g	-
Onions	5g	5g
Palm oil	150ml	150ml
Water	1750ml	1750ml
Hot leaf	100g	100g

Shelled groundnut was toasted for 5 minutes and milled into powder. The stock was prepared by boiling washed beef, stock fish, deboned dried fish, locust bean ('*dawadawa'*), onion, pepper, salt and bouillon cube for 10 minutes. The blended groundnut seeds was added and then simmered for 5 minutes. Oil was added and simmered for 10 minutes. Hot leaves were added and simmered for 2 minutes and cooking was terminated.

2.3 Soup 2:Ogoja method

Raw groundnut seeds were milled and soaked in 35ml of water for 5 minutes. Oil was heated lightly in a pot and chopped onion was fried. Soaked groundnut was poured in and fried lightly for 5 minutes stirring continuously to avoid sticking to the pot or pan. The stock was prepared by boiling washed beef, stock fish, deboned dried fish, onion, pepper, salt and bouillon cube for 10 minutes. The stock was added into the groundnut mixture and stirred and allowed to simmer for 10 minutes. Blended crayfish was added and simmered for five minute. Hot leaf was added and simmered for 2 minute and cooking was terminated

2.5 Chemical analysis

2.5.1 Preparing sample for analysis;

The cooked soups were separately dehydrated using a food dehydrator at 50℃, after drying, they were separately homogenized with the aid of an electric blender (Kenwood) into powder, and the homogenized samples were packed in an airtightContainer and stored in a refrigerator before taken for analysis. Before dehydration 5g of the cooked soup was used for the determination of moisture in wet weight basis.

2.5.2 Amino Acid analysis

Ground samples were first dried at 100 degrees and homogenized after which the samples were prepared for amino acid determination by acid hydrolysis with 6N HCl for 24 hours at 110°C in vial under vacuum and N2 atmosphere. Sample solution was evaporated and dissolved in sodium citrate buffer (pH 2.2). The hydrolysates were analyzed by a post-column derivative method using a HPLC, which was combined with a Pickering PCX5200 derivatizer (Pickering Laboratories, Inc., USA) and ion exchange column (3.0 × 250 mm, 8µm). The identification of amino acids was Spectrometrically performed by measuring at
570 nm. (Naah *et al.*, 1986).

2.5.3 PROXIMATE ANALYSIS

Protein, moisture (actual and residual), fat, ash, soluble and insoluble dietary fibre and minerals were determined according to the methods described by AOAC. Moisture was determined using the air oven method. Crude protein and fat were determined by Kjeldahl procedure and Soxhlet solvent extraction method, respectively. Total dietary fibre was determined by enzyme gravimetric method of Prosky *et al* (1988). Ash was determined by incineration of samples in a muffle furnace at 550°C for six hours. Available carbohydrate was calculated by difference 100− (moisture + protein + fat + ash + dietary fibre) (FAO, 1998).

2.5.4 Mineral analysis

The phosphomolybdate method described by method Yuen and Polland was

Used determine Phosphorus. Potassium and Sodium were determined by flame photometer (Jenway, PF 7, Essex UK) while calcium, magnesium, iron and zinc were determined by Atomic absorption spectrophotometer (Unicam Analytical system, Model 919, Cambridge, UK.

2.5.6 VITAMIN A analysis

The spectrophotometric method was employed in the determination of vitamins content.

2.5.6.1 Vitamin A (Retinol) Determination:

Three different test tubes were prepared into which 0.2ml of alcoholic potassium hydroxide was added to sample, standard, and blank test tubes. Distilled water of 0.2ml volume was added to blank test tube alone. The mixture formed was mixed on the vortex for 10-20 sec with the tubes stoppered. The test tubes were then placed on a water bath at approximately 55-60°C for 20min. A prepared 0.2ml 1:1mixture of xylene: kerosene was added after 20min of cooling the samples to room temperature and mixed. Retinol was extracted by vigorous mixing of each tube on the vortex for at least 30 sec, and the tubes were centrifuged for 5 min at 600-1000rpm. The xylene-kerosene supernatant formed was carefully withdrawn from the test tubes by a means of Pasteur's pipette and the extracted samples read at 328nm with the aid of a spectrophotometer.

2.5.8 Carotenoid Determination:

Two grams of the powdered sample was weighed and transferred into a 250ml round bottomed flask where 50ml of 20% ethanol solution was added. The mixture was kept under reflux for about 30min and was filtered into a 250ml conical flask. Two test tubes were prepared, 3 each, 2.5ml of the filtrate was placed, and 0.5ml of concentrated nitric acid (HNO2) was added to each. The mixtures were allowed to stand over a hot water bath f or 3min after which the test tubes were cooled and allowed to stand in dark for 15min. The volume of the solution was brought to 5ml with absolute ethanol, shaken and the absorbance measured at 470nm wavelength with the aid of a spectrophotometer. A standard and blank solution was also prepared and read off at the same wavelength

2.5.9 DETERMINATION OF FATTY ACIDS CONTENT

The fatty acids profiles were determined by Gas Chromatography-Mass Spectrometry (GC-MS). Fatty acid methyl esters were prepared using BF3 methanolic solution and extracted with hexane. Gas Chromatography coupled with Mass Spectrometry Analysis. A 2 µl volume of each sample was injected in a HP6890 Series Gas Chromatograph coupled with a Hewlett Packard 5973

Mass Selective Detector. The gas chromatograph was equipped with a split-split-less injector and a Factor Four TM Capillary Column VF- 35ms fused silica column of 5% phenylmethylpolysiloxane, 30m*0.25 mm, film thickness 0. 25µm.The GC oven was set to a temperature range of 100 to 3000C with 60C/min, and a solvent delay of 7 min. The injector temperature was maintained at 230 0C. The carrier gas of the sample was helium at 1.0 mL/min and the sample was injected in the

splitless mode. The MS conditions were the followings: ionization energy, 70 eV; electronic impact ion source temperature, 200^0C; quadrupole temperature,

100^0C; scan rate 1.6 scan/s; mass, 40-500 Amu. For the identification of the compounds the mass spectra of the samples were compared with those of the

NIST/EPA/NIH Mhass Spectral Library 2.0 (El-Beltagi, *et al.,* 2007)

3. RESULTS

This study investigated the nutritional composition of indigenous groundnut soups consumed in Cross River State. Two sets of groundnut soups were prepared using Obudu Method-1 and Ogoja Method -2 as described by Bassey et *al.* (2020).

Table 2: Essential amino acids composition of groundnut soups prepared using two different methods (% composition as consumed)

Parameters	Obudu Method	Ogoja Method
Isoleucine	0.62±0.00	1.61±0.00*
Leucine	1.37±0.00	2.80±0.00*
Lysine	0.65±0.00	1.96±0.00*
Arginine	2.19±0.00	3.57±0.00*
Methionine	0.08±0.00	0.13±0.00*
Phenylalanine	0.39±0.00	0.37±0.32*
Threonine	0.19±0.00	0.18±0.00*
Tryptophan	0.19±0.00	0.38±0.00*
Valine	0.39±0.00	1.10±0.00*
Histidine	0.16±0.00	0.23±0.00*

***Means of 3 replicates. Values are expressed as mean + S.D. values with * on the same row are significantly different (p<0.05).**

Results in Table 2 obtained for amino acid indicated that Ogoja groundnut soup had significantly (p<0.05) higher levels of isoleucine (1.61 ±0.00), leucine (2.80 ±0.00), lysine (1.96 ±0.00), arginine (3.57 ±0.00), methionine (0.13 ±0.00), tryptophan (0.38±0.00), valine (1.10 ±0.00) and histidine (0.23 ±0.00) compared with groundnut soup prepared by Obudu method. However, phenylalanine (0.39±0.00) and threonine (0.19±0.00) levels were significantly higher in Obudu groundnut soup. The comparison of the mineral contents of the groundnut soups prepared by Obudu and Ogoja methods is shown in Table 3. The groundnut soup prepared by Obudu method had significantly (p<0.05) higher contents of Phosphorus (51 ±0.12), Potassium (186±0.41), Magnesium (21 ±0.04), Calcium (44 ±1.21) and Sodium (18 ±4.10) compared with Ogoja method of groundnut soup preparation. Cupper was significantly (p<0.05) higher in the groundnut soup prepared using Ogoja method (0.22 ±0.41).

Table 3: Mineral composition of groundnut soups prepared from Obudu and Ogoja methods in Cross River State, Nigeria **(mg/100g as consumed)**

Mineral	**Obudu**	**Ogoja**
Phosphorus	51 ± 0.12	47 ± 0.08 *
Potassium	186 ± 0.41	167 ± 0.01*
Magnesium	21 ± 0.04	20 ± 0.52*
Calcium	44 ± 1.21	37 ± 1.40*
Sodium	18 ± 4.10	16 ± 1.90*
Cupper	0.17 ± 1.11	0.22 ± 0.41*
Iron	0.96 ± 1.08	0.99 ± 2.01
Zinc	3.06 ± 0.00	3.89 ± 0.97

***Means of 3 replicates. Values are expressed as mean + S.D. values with * on the same row are significantly different (p<0.05).**

Table 4 showed the comparison in mean values of fatty acids of groundnut soup prepared according to Obudu and Ogoja methods. The mean value of palmitic acid (1.14 ±0.00), Behenic acid (0.13 ±0.00), Oleic acid (11.60 ±0.00) and Linolenic acid (0.06 ±0.00) were significantly higher (p<0.05) in groundnut soup prepared by the Obudu method compared to the Ogoja method, while lauric acid (0.022 ±0.00), and Linoleic acid (1.92 ±0.00) were statistically higher (p<0.05) in groundnut soup prepared by the Obudu method compared to Ogoja method. Stearic acid was not significantly different.

TABLE 4: Fatty acids composition of groundnut soup prepared using two different methods of preparation (% composition as consumed)

Parameters	Obudu Method	Ogoja Method
Palmitic %	1.14 ± 0.00	1.12 ± 0.00*
Stearic %	0.91 ± 0.00	0.91 ± 0.00
Lauric %	0.002 ± 0.00	0.022 ± 0.00*
Behenic %	0.13 ± 0.00	0.08 ± 0.00*
*L-O %	0.002 ± 0.00	0.006 ± 0.00*
Oleic %	11.60 ± 0.00	7.96 ± 0.00*
Linoleic %	1.60 ± 0.00	1.92 ± 0.00*
Linolenic %	0.06 ± 0.00	0.04 ± 0.00*

***Means of 3 replicates. Values are expressed as mean + S.D. values with * on the same row are significantly different (p<0.05).**

Table 5: Proximate composition of groundnut soup prepared using two different methods of preparation (% composition as consumed)

Parameters	Groundnut Soup Obudu Method	Groundnut Soup Ogoja Method
Protein	10.1 ± 0.04	10.9 ± 0.08*
Fat	12.1 ± 0.08	9.4 ± 0.08*
Ash	2.2 ± 0.17	2.5 ± 0.15*
Available carbohydrate	68.9 ± 0.27	71.3 ± 0.23*
Moisture	69.6 ± 0.09	74.0 ± 0.38*
Dietary Fiber	6.8 ± 0.01	6.0 ± 0.01*

***Means of 3 replicates. Values are expressed as mean + S.D. values with * on the same row are significantly different (p<0.05).**

Table 5 presents the proximate compositions of the groundnut soups prepared using Obudu and Ogoja methods. The mean value of protein (10.1 ±0.04%), moisture (69.6±0.09%), and available carbohydrate (68.9 ±0.27%) were significantly (p<0.05) lower in groundnut soup prepared by the Obudu method when compared to the Ogoja method, Fat, (12.1 ±0.08%) and dietary fibre (6.8 ±0.01%) were significantly (p<0.05) higher in groundnut soup prepared by the Obudu method compared to the Ogoja method of preparation. No significant differences were observed in the ash contents of the soups.

Table 6 presents the vitamin A and carotenoid contents of groundnut soup prepared by Obudu and Ogoja methods. The mean value of α-Carotenoid (280 ±0.01ug), β-Carotenoid (389 ±0.01ug), β-Cryptoxanthin (412 ±0.09ug) and Vitamin A (53 ± 0.04mcg) were significantly (P<0.05) higher in groundnut soup prepared by Ogoja method when compared to the Obudu method.

Table 6: Carotenoid and Vitamin A composition of groundnut soup prepared using two different methods of preparation (mcg/100g)

Parameters	Groundnut Soup Obudu Method	Groundnut Soup Ogoja Method
α-Carotenoid	206.00 ± 0.01	280.00 ± 0.01*
β-Carotenoid	306.00 ± 0.01	389.00 ± 0.01*
β-Cryptoxanthin	339.00 ± 0.01	412.00 ± 0.09*
Vitamin A	51 ± 0.01	53 ± 0.44*
Total vitamin A (RAE)	311	383

***Means of 3 replicates. Values are expressed as mean + S.D. values with * on the same row are significantly different (p<0.05).**

4. DISCUSSION

The higher Arginine and Leucine contents in the soup prepared using the Obudu method of groundnut soup preparation could be attributed to the inclusion of locust bean seed (‘*dawadawa*’) since locust bean is known to be rich in these amino acids. The appreciable amino acids observed in the soups is not surprising as the result of the study by Amankwah *et al*., (2015) showed the presence of amino acids in groundnut seeds as thus: Threonine (10.70%), isoleucine (1.96%), leucine (4.13%), phenylalanine (3.55%).

Phosphorus concentration in most food ranges approximately from (7.8 to 20.1 mg/g protein.

Phosphorus concentration was found in large amount in soup prepared by Obudu method, although, Ayoola *et al.* (2012) had earlier reported low amount of phosphorus in groundnut seed. The reason for the increase in Phosphorus in the present study may be due to the addition of other ingredients such as hot leaf and ‘*dawa-dawa*’ in the soup. Phosphorus just like calcium play crucial role in bone and teeth development. It is important to note that phosphorus from food sources are relatively bioavailable with the exception of plant seeds (beans, peas, cereals, nuts) that contain a special form of phosphate called phytic acid (Ayoola *et al.* (2012).

The average daily intake of potassium in adult is about 2,320mg for men and 3,016mg for men. In this study, Potassium concentration was found in appreciable amount in soups prepared using Obudu method. The result contradicts that of Jacob *et al.,* (2015), who reported a low content of Potassium in groundnut seed. The increase in K content as observed in the present study might be attributed to the addition of hot leaves, which may have probably boosted the mineral contents of the soup. Low potassium is associated with a risk of high blood pressure, heart disease, stroke, arthritis, cancer, digestive disorders, and infertility.

Sodium was below the recommended levels in the analyzed food samples. There is abundant evidence that a reduction in dietary sodium and increase in potassium intake decreases blood pressure, incidence of hypertension, mobility and mortality from cardiovascular diseases (Whelton and He, 2014). Average intake of magnesium for Men 350mg and 267mg for women has been recommended. This study showed that magnesium content was higher in soup prepared by Obudu method compared with Ogoja method. Magnesium is beneficial to blood pressure and helps to prevent sudden heart attack, cardiac arrest and stroke while its deficiency results in uncontrolled twisting of muscles leading to convulsion (Rude, 2010). For adult, the recommended magnesium allowance is based on an estimate of 200 to 250mg/day, calcium concentration was again lower in the soup prepared using Ogoja method. Calcium is a constituent of bones and helps the body to contract correctly, blood to clot and the nerves to convey messages (Achu *et al.,* 2015). The Ca/P ratio of all the soup is more than the standard of 0.5. Higher Ca/K levels in food is required for favourable calcium absorption for bone health (Nieman *et al*., 2012). The Ca/P ratio in this study indicates that all the soup type would help calcium absorption in the body. The RDA of sodium for adults is less than 2,000mg. Excess sodium in the diet can lead to cardiovascular related disease conditions among others (Mozaffarian *et al*., 2014). Studies had shown that lower sodium and higher potassium intake helps to reduce high blood pressure in hypertensive patients. The recommended Na/K ratio should be less than one. The Na/K value of 0.09 was obtained in groundnut soup prepared by Ogoja method in this study. The report of this investigation revealed that regular consumption of the groundnut soup prepared with hot leaves would help to prevent hypertension and might lower blood pressure in hypertensive patients. Copper, is an essential micronutrient. It is involved in lipid metabolism, bones development, and maturation of connective tissue (Morakinyo *et al.,* 2016). The result of the present study indicates that copper content is sufficient in the soups. Iron (Fe) content was observed to be within normal range in values reported in soups but contradicts the earlier study of Morakinyo *et al.,* (2016), who reported high content of iron in some Nigerian traditional soups. The reason for the difference in iron content might have been due to the method of preparation of the soup, as well as the recipe used. Iron is the most common micronutrient deficiency in the world (Kumar, 2014). All the soups analyzed contain inadequate proportion of iron when compared with RDA of 18 mg. Thus, dietary iron is not best supplied by consumption of these soups. Dietary intake of zinc range from 4-25mg/day. Zinc was the third least present element, and was found to be normal range in groundnut soup prepared using Ogoja method. However, Lawal *et al.* (2018) had reported that most Nigerian soups are not good source of Zinc. Zinc boosts the health of our hairs, plays a role in the proper function of sense organs (Lawal *et al.* (2018).

The high ratio of unsaturated fatty acid and saturated fatty acid contents of the soups increased their nutritional quality since any food stuffs which contains UFA/SFA ratio greater than one is an indication of improved nutritional benefits of such food. The result obtained in this study on stearic acid is in agreement with Oguntona and Adekoya (2010). Lauric, Behenic and Lign-oceri acids were in trace amount in the two soups, this indicates that the groundnut soups have lower amount of saturated fatty acids. Oleic and linoleic acid were inappreciable amount in the two soups. Studies have shown the beneficial effects of unsaturated fatty acids especially in cardiac health and brain development in children among other health benefits (Soumia *et al,* 2013), making these soups recommendable.

The higher protein content of the soup prepared using Ogoja method might be **a**ttributed to the method of preparation. The difference in the methods of preparation is in the toasting of the groundnut. Studies have observed lower protein contents of toasted/roasted foods [Seenaa *et al*., 2006].

It is not surprising that the groundnut soup that was prepared using method 1 had the highest fat content, this observation can also be attributed to toasting. Toasting reduces moisture and protein, leading to more concentration of fat.

The reduced ash (2.2%) content of the soup prepared using method 1 is an indication of lower mineral content (Popov *et al.,* 2011).

The higher contents of carotenoids and vitamin A contents of the soup prepared using the Ogoja method could be attributed to the method of preparation. Toasting of the groundnut prior to use might have affected the carotenoids and the vitamin A contents of the soup prepared using the Obudu method because toasting/roasting have been shown to reduce the vitamins and carotenoids contents of nuts (Stuetz *et al*.,2016). With 44 to 55% contributions of a 100g of these soups to the RNI/day of vitamin A in adults, the soups can be regarded as good sources of vitamin A. Vitamin A is one of the vitamins of public health importance and which deficiencies can lead to poor night adaptation, xerosis, keratomalacia and other vision-related functions (NIH, 2017).

Conclusion:
The soups varied in their nutritional composition basically due to the recipe and processing, and food preparation methods used. The groundnut soup that was prepared using the Obudu method of preparation had higher phosphorus, magnesium, calcium and sodium contents, while its counterpart, had higher levels of all the amino acids assessed, α-Carotenoid, β-Carotenoid, β-Cryptoxanthin and vitamin A compositions. The Groundnut soups are also good sources of monounsaturated and polyunsaturated fatty acid with Oleic acid being the most abundant of the fatty. Consumers can leverage on the comparative advantage of each nutrient to make a choice of the soup preparation method to adopt.

REFERENCES:
Aburime, L. C., Eno-Obong, N. H., David-Oku, E. (2020). Effect of citric acid treatment and fermentation on the chemical composition of African Yam Bean (*Spenostylis stenocarpa*) and sensory evaluation of its Gruel. European Journal of Nutrition and Food Safety. 51-65.
Achu, P. S., Abbah, A. G., Santh I. J (2015). Mineral composition of groundnut (Arachis Hypogea) seeds. America journal of Food and Nutrition. 5(8): 44- 48.
Amankwah, E. N., Adu, E., John, B. and Dossou, V. A. (2015). Amino acids of some varieties of rice, soyabean and groundnut grown in Ghana. Journal of Food Process Tech. 6(2):11-16.
AOAC (2012). Official methods of analysis (18th ed.; W. Horwitz, Ed.). Gaithersburg, MD: Association of Official Analytical Chemists.
Ayoola, P. B., Adeyeye, A and Onawumi,O. O. (2012). Chemical evaluation of food value of groundnut (Arachis hypogea) seeds. American Journal of Food and Nutrition, 2157-1317
Bansal, U. K., Satija, D. R. & Ahula, K. L. (2012). Oil composition of diverse groundnut (Arachis hypogaea L.) genotypes relation to different environments. Journal of Food Science, 63, 17-19.
Bassey, S.O, Aburime, L.C, Ijokgwung, G.E, Onabe, V and Agiang, M.A (2020). Standardization and Nutrient Composition of Melon and Groundnut Soups as Consumed in Cross River State, Nigeria. Asian Food Science Journal, 17(3): 34-43, 2020; Article no.AFSJ.59545.
Ergul, N. (2018). Peanut Production. Mediterranean Agriculture Research Institute, Ankara-Turkey, Publ. Nut. pp.308.
FAO (2012). The state of food insecurity in the world: Economic growth is necessary but not enough to accelerate reduction of hunger and malnutrition. Rome, Italy; 2012.
FAO, IFAD, UNICEF, WFP & WHO (2018). The state of food security and nutrition in the world, 2018. Building climate resilience for food security and nutrition. Rome, FAO, Licence. CC BY-NC-SA 3.0. IGO.
FAO/WHO Expert Consultation (1998). Carbohydrates in Human Nutrition: eport of a joint FAO/WHO Expert Consultation, Rome, 14–18 April 1997. Rome: hFood and Agriculture Organization, (FAO Food and Nutrition Paper 66).http://www.fao.org/docrep/w8079e/w8079e00.htm.
Jacob, A. G., Etong, D. I. and Tijjani, A. (2015). Proximate, mineral and anti nutritional composition of melon (Citrullus lanatus) seed. Bri J research. 2(5): 142-151.
Jambunathan, R., Raju, S. M. and Barde, S. P. (2015).Analysis of groundnut content by nuclear magnetic resonance spectrometry. J. Sci. food Agric. 36:162-166.
Kayode A. and Kayode O.T., (2011). Some medicinal values of Telfairia occidentalis: A review. Am. J. Biochem. Mol. Biol., 1: 30-38.
Kayode, O. F., Ozumba, A. U., Ojeniyi, S., Adetuyi, D. O. & Erukainwe, O. L.(2010). Micronutrient content of selected indigenous soups in Nigeria. Pakistan Journal ofNutrition, 9(10):962-965.
Kumar, R. (2014). Anemia: A common health problem, consequence and diet anagement among young children and pregnant women. Biological Forum An International Journal. 6(1):27-32.
Latham, M. G. (2010). Human Nutrition in Developing World. Rome, Food. Nutr. Series, 315.
Lawal, O. M., Idowu-Adebayo, F. and Enujiugha, V. N. (2018). Nutritional assessment of Nigerian ethnic vegetable soups (Marugbo, Tete and Ila). J Nutri Food Lipid Sc. 1:32-39.
Morakinyo, A. O., Samuel, T. A and Adegoke, O. A. (2016). Mineral composition of commonly consumed local foods in Nigeria. African J. Biomed Res. 19:141- 147.
Mozaffarian D., Fahimi S., Singh G.M., Micha R., Khatibzadeh S. Global sodium consumption and deaths from cardiovascular causes. New Engl. J. Med. 2014; 371:624–634
Naah, Shin, M.S., Jhon, D.Y., Hong, Y. H. (1986). Studies on the changes in free amino acids of yellow corvenia (Pseudosciaena manchurica) during Gulbi processing. J. Kor. Soc. Food Nutr. 15: 263-275.
National Institute of Health (NIH) (2016). Fact Sheet for Health Professionals: Calcium. National Institute of Health, Office of Dietary Supplements. Retrieved on 21st of march 2019 from https://ods.od.nih.gov/factsheets/CalciumHealthProfessional/

Nieman, D. C., Gillitt, N., Jin, F., Henson, D. A., Kennerly, K., Shanely, R. A., Schwart, S. (2012). Chia seed supplementation and disease risk factors in overweight women: A metabolomics investigation. The Journal of Alternative and Compl Medicine. 18(7):700-708.

Oguntona, C. R. B. & Adekoya, A. S. (2010). Recipe standardization andNutrient composition of some Nigerian Dishes. West African Journal of Food and Nutrition, 2, 66-74.

Popov V. K., Posokhov, Y.M., Rachev I. L., Zaostrovskii, A. N. (2011). Therelationship between the Mineral matter and ash contents of coals from the bogatyr strip mine of the ekibastuz deposit. Lid Fuel Chemistry. 45(2):12832.

Prosky, L., Asp, N. G., Schweizer, T. F., DeVries, J. W. & Furda, I. (1988). Determination of insoluble, soluble and total dietary fibre in foods and food products: Interlaboratory study. Journal - Association of Official Analytical Chemists, 71: 1017–23.

Reeds J., Mansuri, S., Mamakeesick, M., Harris, S. B., Zinman, B., Gittsohn, J., Wolever, T. M., Connelly, P. W., Hanley, A. (2016). Dietary patterns and type 2 diabetes mellitus in a first nation community. Canadian Journal of Diabetes. 40(4):304-310.

Rude, R. K (2010). Magnesium. In: Coates P.M., Betz, T.M., Editors. Encyclopaedia of Dietary Supplements. 2nd Ed. Informa Healthcare. New York, NY, USA. pp. 527-537.

Savage, G. P., and Keenan, J. I. (2014).The composition and nutritive value of groundnut kernels. In: Smart J. (ed).the groundnut crop: scientific basis for improvement. London: Chapman and Hall, pp.173-213.

Seenaa S, Sridhara KR, Arunb AB, ChiuChung Young. Effect of roasting and pressure-cooking on nutritional and protein quality of seeds of mangrove legume Canavalia cathartica from southwest coast of India. Journal of Food Composition and Analysis. 2006;19,284– 293.

Shenkin, A. (2013). Micronutrients in health and disease. Postgraduate Medical Journal. 82:559-567.

Soumia P., Sandeep C., Jubbin J.J. A fish a day keeps the cardiologist away – a review of the effect of omega 3 faty acids in the cardiovascular system. India J. Endocrinol. Metab. 2013;17(3):422–429.

Stuetz, W., Schlormann, W and Glei, M (2016). B-vitamins, carotenoids and α-/γ- tocopherol in raw and roasted nuts. Food Chemistry.221.

USDA (2017): Foreign Agricultural Service (FAS) of the Department of Agriculture US. http://www.nal.usda.gov/fnic/foodcomp/search/. Accessed 21 Aug 2019

Whelton, P. K. and He, J. (2014). Health effects of sodium and potassium in humans. Current Opin Lipidol. 25(1):75-59.

Yuen SH and AO Polland. The determination of phosphorus in plants and soils by molybdenum method. Journal of the Science of Food and Agriculture 1955; 6:223-225