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Micro Nutrient Content of Selected Indigenous Soups in Nigeria

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Abstract: The micronutrient content of selected standardized indigenous soups from the six geopolitical zones of Nigeria was analyzed with reference to iron, calcium, phosphorus, sodium and potassium contents of the soups. Results revealed a high iron level in ogbono soup; Egusi + vegetable soup showed a very low level of calcium, while afang and soko soup had a relatively high level; Turkey stew and ogbono soup had a very high level of phosphorus, while the other soups had adequate levels except for egusi + vegetable soup which was extremely low; while egusi + vegetable, onugbu, edikang-ikong and miyan kuka soups had high levels of potassium. This study has established that the selected soups from the six geopolitical zones of Nigeria are good sources of micronutrients.

Key words: Micronutrients, indigenous soups, Nigeria

INTRODUCTION

There is growing interest in the role of the micronutrients (essential trace elements and vitamins) in optimizing health and in prevention or treatment of disease (Field *et al*., 2002). This stems partly from the increase in knowledge and understanding of the biochemical functions of these nutrients (Shenkin, 2006). Micronutrients have been reported to play an important role in mounting immune response and deficiency of single micronutrients alone, or in combination with other micronutrients, substantially increase the risk of having a poor immune response to infection (Walker, 2000; Black, 2001). They also influence adult and child productivity as well as educational achievement, child survival and maternal health (FSAU, 2005).

Dietary intakes in developing countries usually consist of plant-based staple foods which are monotonous with little variation. Methods of preparation and storage of these foods often leads to large loss of micro nutrients thus creating a deficiency risk of micro nutrient. Owing to the importance of micronutrients, efforts have been geared towards the study of the mineral composition of prepared Nigerian foods (Akindahunsi and Oboh, 1999; Elemo *et al*., 2010a).

Nigeria is multi-cultural society with different traditional soups which are indigenous to the different ethnic and cultural society. This study therefore aims at determining the iron, calcium, phosphorus, sodium and potassium contents of selected standardized indigenous soups from the six geopolitical zones of Nigeria. This is to promote consumption of soups which are rich naturally in micronutrient within different ethnic groups so as to reduce occurrences of some micronutrient deficiencies.

MATERIALS AND METHODS

Ingredients: Ingredients used were purchased from local markets at Mushin, Oto and Oshodi all in Lagos, Nigeria.

Preparation of soups: The selected soups from the six geopolitical zones are presented in Table 1. The dishes were prepared in the kitchen facilities of the department of food and analytical services of the Federal Institute of Industrial Research, Oshodi, Nigeria. The preparation methods used for the selected recipes are those earlier established by cookery and recipe books (Food specialties, 1988; FIIRO, 2006), with some modifications by the indigents of the geopolitical zones familiar with such soups. Each dish was prepared in triplicates and analysis carried out on fresh weight basis.

Sample collection and preparation: Each soup was cooled to room temperature and equal portion of the dishes were homogenized with a warring blender. Samples of the meals were analyzed in-situ for moisture and ash contents at 105 and 550 degrees Celsius in air-oven and muffle furnace respectively.

Determination of moisture content: This was carried out according to methods described by AOAC (1999).

Mineral analysis: 1 gram of each soup sample was transferred to acid washed crucibles and dry-ashed in a muffle furnace at 550^{o}C initially for 2 h until well ashed. The ash was dissolved and made up into 100ml solution prior analysis.

The iron, phosphorus, calcium, sodium and potassium contents of all the food samples were determined on aliquots of the solutions of the ash by UV/Visible and atomic absorption spectrophotometers (AOAC, 1999). Replicates of soup composites were analyzed to check the homogeneity of the portions sampled from the soup and the reproducibility of the method. The accuracy of the method was studied by analyzing Orchard Leaves Standard, Reference Material No. 1571, National Bureau of Standards (NBS). Phosphorus was determined by the molybdo-vanadate solution method (AOAC, 1999).

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Table 1: Selected indigenous soups from the six geopolitical zones of Nigeria

South-South	South-East	South-West	*North	General
Afang	Oha	Tete	Miyan kuka	Chicken stew
Edikang Ikong	Ogbono	Soko	Groundnut	Turkey stew
Nsala	Onugbu	Ewedu	§G. nut + vegetable	Beef stew
Banga	Egusi + ugu	Gbegiri	Beans + vegetable	Fish stew

*North: this consists of North Central, North East and North West geopolitical zones. §G. nut: Groundnut

Statistical analysis: Data were reported as mean±standard deviation. Statistical analyses were carried out using SPSS for Windows, version 14.0 (SPSS Inc. Chicago, IL.USA).

RESULTS

The micronutrient composition of selected soups consumed in South-South geopolitical zone of Nigeria is shown in Table 2. Edikang-Ikong had the highest concentration of Iron (6.30±0.25 mg/100 g); this was followed by afang soup (4.20±0.40 mg/100 g), while nsala soup was observed to have the lowest concentration (1.40±0.40 mg/100 g). Afang soup was observed to have the highest concentration of calcium (850±5.00 mg/100 g) with edikang-ikong having the lowest concentration (120±2.52 mg/100 g). The phosphorus concentration of afang and banga soups were observed to be high, while a very high concentration was observed in nsala soup (790±1.15 mg/100 g). Both afang and banga soups had the same concentration of sodium (470±10.00 mg/100 g); edikang-ikong was observed to have the lowest concentration (230±4.58 mg/100 g). Edikang-Ikong was observed to have a very high concentration of calcium (710±4.16 mg/100 g).

Table 3 shows the micronutrient composition of selected soups consumed in South-East geopolitical zone of Nigeria. Ogbono was observed to have the highest concentration of Iron (11.00±2.08 mg/100 g), with onugbu having the lowest concentration (2.00±0.25 mg/100 g). A very low concentration of calcium was observed in Egusi + ugu (4.00±0.31 mg/100 g), while onugbu had the highest concentration (320±1.15 mg/100 g). Phosphorus was observed to be very low in Egusi + ugu (46.0±1.32 mg/100 g) compared to ogbono which had a rather very high concentration (1840±2.65 mg/100 g). Onugbu was observed a very high concentration of sodium (274.4±5.03 mg/100 g) with egusi + ugu having the lowest (160±1.50 mg/100 g). A high concentration of potassium was observed in egusi + ugu with onugbu having the highest concentration (840±1.15 mg/100 g).

The micronutrient composition of selected soups consumed in the South-West geopolitical zone of Nigeria is presented in Table 4. Ewedu was observed to have the highest concentration of iron (4.60±0.17 mg/100 g), this was followed by tete (3.20±0.12 mg/100 g); while a rather low concentration was observed in gbegiri. Soko was observed to have the highest concentration of calcium (500±1.15 mg/100 g), while gbegiri had the lowest (75.0±1.52 mg/100 g). Ewedu had the lowest concentration of phosphorus (170±0.58 mg/100 g) compared to soko (650±2.08 mg/100 g) which was highest. Gbegiri, soko and tete had higher concentrations of sodium, with gbegiri having the highest concentration (490±2.31 mg/100 g). A concentration of potassium was observed in ewedu (570±1.73 mg/100 g), while tete had the lowest concentration (128±1.15 mg/100 g).

The micronutrient composition of soups consumed in northern Nigeria is presented in Table 5. Miyan kuka was observed to have the highest concentration of iron (3.10±0.26 mg/100 g), while groundnut + vegetable had the lowest concentration (1.20±0.20 mg/100 g). Groundnut + vegetable was observed to have the highest concentration of calcium (190±2.64 mg/100 g), while beans + vegetable and groundnut had the same concentration (90.0±1.15 mg/100 g). Groundnut + vegetable had the highest concentration of phosphorus (540±1.52 mg/100 g), while miyan kuka had the lowest concentration (180±1.65 mg/100 g). All soups were observed to have close range of sodium concentration except groundnut + vegetable (165±1.15 mg/100 g). Miyan kuka was observed to have the highest concentration of potassium (840±1.15 mg/100 g).

Table 6 shows the micronutrient composition of selected soups general consumed in Nigeria. Both turkey and beef stews were observed to have the same level of iron concentration (5.00 mg/100 g), while a close range was also observed in chicken and fish stews (11.00 and 10.00 mg/100 g). Turkey stew had the highest concentration of calcium (200±1.15 mg/100 g), while beef stew had the lowest concentration (110±1.52 mg/100 g). A rather very high concentration of phosphorus was observed in turkey stew (1830±1.27 mg/100 g), while chicken stew had the lowest concentration (100±1.04 mg/100 g). Chicken stew was observed to have the highest concentration of sodium (190±2.89 mg/100 g), with the others had concentrations of close ranges. Potassium concentration was observed to be low (140±1.15 mg/100 g) compared to that of fish stew (430±1.78 mg/100 g) which was highest.

Table 2: Micronutrient composition of soups from South-South geopolitical zone of Nigeria

Soups	Moisture	Ash	Iron	Calcium	Phosphorus	Sodium	Potassium
Afang	76.92±0.88	2.10±0.30	4.20±0.40	850±5.00	550±4.04	470±10.00	110±3.61
Banga	77.30±1.59	3.18±0.25	3.00±0.66	180±7.64	510±6.81	470±11.53	70±3.61
Edikang Ikong	76.25±0.52	4.50±0.76	6.30±0.25	120±2.52	700±6.81	230±4.58	710±4.16
Nsala	78.1±0.30	3.28±0.25	1.40±0.40	310±2.52	790±1.15	300±1.53	100±1.53

Data = mean±SD; n = 3. Values of minerals are in mg/100 g

Table 3: Micronutrient composition of soups from South-East geopolitical zone of Nigeria

Soups	Moisture	Ash	Iron	Calcium	Phosphorus	Sodium	Potassium
Egusi + ugu	63.11±0.25	2.94±0.05	3.00±0.11	4.00±0.31	46.0±1.32	160±1.50	260±4.04
Oha	77.30±1.59	2.84±0.05	4.00±0.30	250±1.15	480±1.53	430±2.52	30±1.15
Ogbono	70.44±0.27	6.05±0.13	11.00±2.08	120±2.08	1840±2.65	250±0.58	82.8±0.40
Onugbu	74.23±0.52	4.67±0.28	2.00±0.25	320±1.15	770±1.15	2744±5.03	840±1.15

Data = mean±SD; n = 3. Values of minerals are in mg/100 g

Table 4: Micronutrient composition of soups from South-West geopolitical zone of Nigeria

Soups	Moisture	Ash	Iron	Calcium	Phosphorus	Sodium	Potassium
Ewedu	90.92±0.06	2.07±0.03	4.60±0.17	120±1.25	170±0.58	240±1.00	570±1.73
Gbegiri	73.84±0.21	1.54±0.05	0.80±0.11	75.0±1.52	218±1.15	467±1.53	475±1.53
Soko	69.35±0.08	2.97±0.05	1.40±0.06	500±1.15	650±2.08	490±2.31	180±3.06
Tete	76.86±0.05	2.94±0.03	3.20±0.12	160±1.53	480±1.26	420±1.70	128±1.15

Data = mean±SD; n = 3. Values of minerals are in mg/100g.

Table 5: Micronutrient composition of soups from *Northern Nigeria

Soups	Moisture	Ash	Iron	Calcium	Phosphorus	Sodium	Potassium
Beans + Vegetable	74.67±0.63	1.36±0.03	1.80±0.13	90.0±1.15	304±1.53	467±1.15	480±1.53
Groundnut	60.58±0.12	1.76±0.05	1.90±0.30	90±1.15	470±1.53	479±4.04	483±1.15
Groundnut + Vegetable	60.67±0.05	1.87±0.05	1.20±0.20	190±2.64	540±1.52	165±1.15	500±1.78
Miyan Kuka	78.33±0.09	1.99±0.06	3.10±0.26	120±1.53	180±1.65	480±2.08	840±1.15

*Northern Nigeria: this consists of North Central, North East and North West geopolitical zones.
Data = mean±SD; n = 3. Values of minerals are in mg/100 g

Table 6: Micronutrient composition of soups generally consumed in all the six geopolitical zones of Nigeria

Soups	Moisture	Ash	Iron	Calcium	Phosphorus	Sodium	Potassium
Beef stew	40.16±0.03	2.18±0.11	5.00±0.29	110±1.52	270±1.15	150±2.87	320±1.53
Chicken stew	57.78±0.05	4.69±0.10	1.10±0.10	190±2.51	100±1.04	190±2.89	140±1.15
Fish stew	40.30±0.25	3.95±0.10	1.00±0.12	130±2.65	500±1.53	140±1.73	430±1.78
Turkey stew	41.96±0.05	6.47±0.05	5.00±0.50	200±1.15	1830±1.27	160±1.00	200±1.73

Data = mean±SD; n = 3. Values of minerals are in mg/100 g

DISCUSSION

Dietary studies in developing countries have consistently shown that multiple micronutrient deficiencies, rather than single deficiencies, are common and that low dietary intake and poor bioavailability of micronutrients account for the high prevalence of these multiple deficiencies (MI, 2000). This paper reports the mineral contents of selected indigenous soups from the six geopolitical zones of Nigeria.

The metabolic roles of minerals and the amounts of them in the body vary considerably (Wardlaw, 1999). Ogbono appeared to have an exceptionally high level of iron probably due to the ingredients and inclusion of meat which is a source of iron (Onabanjo and Oguntona, 2003). Chicken and fish stews, edikang-ikong and ewedu soups had appreciable levels of iron content too. The adult RDA for iron is 10 mg/day for men and 15 mg/day for women indicating that the selected stews and soups will be able to meet the daily dietary iron requirements (Wardlaw, 1999). This corresponds to earlier reports that most Nigerian natural foods are rich in iron (Latunde-Dada, 1997). Iron deficiency has been reported to be extremely common in the developing world, with >50% of the world's population having some degree of deficient iron status based on a wide variety of tests (Openheimer, 2000). This corresponds to studies by Elemo *et al.* (2010b) on the iron status of premenopausal women in a Nigerian university. They reported that these women were at a very high risk of nutrition anaemia. This could be attributed to their regular diet, socioeconomic status and consumption pattern. However, the presence of anti-nutrients such as phytate in food could reduce iron absorption and utilization in humans.

Calcium has been reported to be the most abundant mineral in the human body, with 99% of it contained within bones and teeth. The other 1% found in the cellular and extracellular fluid is important for biological functions (Wardlaw, 1999). Egusi + vegetable soup showed a very low level of calcium, while afang and soko soup had relatively high levels but not sufficient to meet the Adequate Intake (AI) of calcium for adults (1000-1200 mg/day) and adolescence (1300 mg/day). Calcium deficiency is certainly a risk factor for osteoporosis in later life (Allen, 2001). This makes supplementation very important. Flesh and sea foods are often included in these soups and also consumed with tuber or cereal-based dishes such as cooked cassava, yam, plantain, rice or maize- based dishes thus improving the calcium level.

Although no disease is currently associated with an inadequate phosphorus intake, its deficiency may contribute to bone loss in elderly women (Wardlaw, 1999). Turkey stew and ogbono soup had a very high level of phosphorus, while the other soups had adequate levels except for egusi + vegetable soup which was extremely low. This indicates that the soups can meet the daily requirements of phosphorus (RDA for adults is $\geq$700 mg/day).

Sodium is the major positive ion in the extracellular fluid and a key factor in retaining body water. All the soups analysed had values within the RDA. Under the FDA food-labeling rules, the Daily Value for sodium is 2400 mg (Greely, 1997). High sodium content has been shown to contribute to hypertension in susceptible individuals, leading to increased calcium loss in urine (Wardlaw, 1999).

Potassium plays a similar role with sodium in the biological system, but it is located in the intracellular fluid. Unlike sodium it associated with lower rather than higher blood pressure values (Wardlaw, 1999). Potassium level was high in egusi + vegetable, onugbu, edikang-ikong and miyan kuka soups but this is far below the RDA (2000 mg/day). Deficiency in potassium leads to an irregular heartbeat, loss of appetite and muscle cramps. But as earlier stated these soups are often not consumed alone but with other food types which could improve the potassium level.

Conclusion: This study has established that the selected soups from the six geopolitical zones of Nigeria are good sources of micronutrients. The general stews are usually combined with some of the soups in the different geo-political zones thereby increasing the concentration of these micronutrients in the diets especially, beef, fish and poultry foods which are rich in Iron and calcium.

However, the presence of anti nutrients such as phytate especially in cereals such as maize and millet could affect the utilization of some of these micronutrients. Consumption with other food type with caution is recommended so as to improve the micronutrient level.

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