Proximate, Minerals and Vitamins Analyses of Some Common Foods in Nigeria

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Abstract

Nutritional composition is a key factor that must be considered in our daily choice of diets. Hence, the need for nutritional analysis of these five (5) common Nigerian solid foods (poundo yam, semovita, corn flour, cassava flour, and wheat flour). The flour samples were chemically analysed for proximate and Mineral elements: magnesium, iron, sodium and calcium composition, using the methods described by Association of Analytical chemist. Vitamin A content was determined by spectrophotometric method while Vitamin C content was determined using the spectrometric method coupled with DNPH procedures. The result revealed that Poundo yam had the highest carbohydrate content (82.695%) and least in the following parameters; moisture (7.55%), calcium (30.075mg), iron (9.20mg), sodium (15.565mg), and magnesium (26.185mg) among other samples. Semovita has the highest protein content (16.3%), vitamin A (0.52mg) and vitamin C (3.61mg). Wheat flour was rated highest in ash (1.82%) and sodium (25.3mg) contents respectively. It was also observed that wheat flour had the least content of vitamin A (0.09mg). Corn flour is highest in crude fat (5.5%). Cassava flour had the highest crude fibre (1.9%), calcium (228.55mg), iron (17.85mg) and magnesium (88.55mg), and turned out to be least in protein (1.025%) and vitamin C (0.44mg) content.

Keywords: *Proximate, Minerals, Vitamins, pounded yam, poundo yam, semovita, corn flour, cassava flour, and wheat flour*

1. Introduction

Nutrition is now a major modifiable determinant of chronic diseases, with scientific proof increasingly supporting the opinion that changes in diet have strong effects on health throughout lifetime. Di*et al*teration may not only influence present health condition, but may determine whether or not an individual will develop diseases such as obesity, diabetes, cardiovascular diseases, hypertension, and certain cancer much later in life (WHO/FAO, 2003). Rapid change in disease pattern had been linked to alterations in diet and lifestyle. The urban based settlements in Nigerian is now shifting from exercise and agrarian lifestyle to a more sedentary urban lifestyle, resulting into diseases like diabetes, hypertension, obesity and certain cancers. Cheap imported foods, socio-cultural changes global markets and are placing African traditional diets at distinct disadvantages.

Indigenous diets are being replaced with more refined carbohydrate fast foods (Ifeyironwa, Eyzaquirre, Matig, & Johns, 2006). In tackling the multiple problems of food insecurity, nutrition transition and the double burden of diseases, it is essential to mobilize and employ indigenous foods like carbohydrates as part of the solution (SCN, 2006). This is because several studies have reported immense nutritional benefits and health protecting properties of African indigenous foods such as cereals and tubers (Obizoba & Souzey, 1989; Enwere, 1998; Ene-Obong & Carnovale, 1992; SCN, 2006; Okeke *et al*, 2009).

Food is any substance, usually composed of carbohydrates, fats, proteins and water that can be eaten or drunk for nutrition (Aguilera and David, 1999).

Human beings require food to grow, reproduce and maintain good health. Without proper and adequate nutrients in the diet, the bodies could not stay warm, build or repair tissues or maintain a heartbeat. Eating the right foods can make human body healthy and prevent certain diseases or recover faster when illness occurs. These and other important functions are performed by chemical substances in the food called nutrients (Worthington-Roberts, 2008).

Food insecurity continues to threaten many households in low income countries like Nigeria. Committee on coordination/Sub-committee on Nutrition state that, the operational definition of household food security is having

access to adequate food needed for a healthy life for all the members of the household (adequate in terms of quantity, quality, safety and culturally acceptable) (Uzam and Muhammed, 2004). Adequate nutrition is essential for individual development, good health, fulfilment of general functions and success in societies and nations (Food and Agriculture Organization (FAO), 2004).

Many factors such as culinary value, nutritional contents, cultural values, availability etc are responsible for the type of indigenous food people consume in this part of the world. However, the nutritional consideration cannot be over emphasized because of its importance on our general wellbeing. Hence, this study aims to determine and compare the nutritional contents of semovita, wheat flour, cassava flour, corn flour, poundo yam and pounded yam.

2. Materials and Methods
Sample Preparation
Food materials (wheat flour, Semovita, corn flour, cassava flour and Poundo yam are brought in powdered and processed forms. Freshly made pounded yam was gotten in the solid form) were visually inspected and organoleptic parameters such as odour and taste were examined for defects. Hence, only healthy food materials were selected. 1kg of these Food samples were weighed, packaged in nylon bags kept in an air tight container and stored in the freezer. Samples were taken out from the freezer prior to analysis.

Reagents used
During the analysis, only reagents of analytical grade were used. The reagents used were sourced from the Biochemistry Laboratory of Prince Abubakar Audu University, Anyigba.

Methods
Proximate Analysis
The proximate composition of the samples were determined by the methods described in Association of Official Analytical Chemist (AOAC) (2010).

Mineral Analysis
The minerals (Sodium (Na), Calcium (Ca), Iron (Fe) and Magnesium (Mg)) content of each sample was analysed using Spectrophotometric and titrimetric methods as applicable in AOAC, (2010)

Vitamin A and C Content of Samples
Vitamin A content of the sample was determined according to the modified spectrophotometric method of Rutkowsk, (2007).

Ascorbic Acid (Vitamin C)
Vitamin C content of the sample was determined using the spectrometric method coupled with DNPH procedures (Rahman *et al*, 2006).

Statistical Analysis
All data are expressed as the mean of three replicates $\pm$ standard error of mean (SEM). Statistical evaluation of data was performed by SPSS version 23. Using one way analysis of variance (ANOVA), followed by Duncan's posthoc test for multiple comparisons. Values were considered statistically significant at $p<0.05$ (confidence level = 95%).

3. Results and Discussion
The results of the Proximate (Table 1), Vitamin (Figure 1) and mineral elements (Figure 2) analyses of the food samples showed they contained in different amount of moisture, carbohydrate, crude fat, crude fibre, crude protein, ash, vitamin A, vitamin C, calcium, iron, magnesium and sodium.

It was observed that poundo yam contained highest amount of carbohydrate while pounded yam has the least carbohydrate content. The order of decreasing carbohydrate content as portrayed by the result of this research is poundo yam> cassava flour> corn flour> semovita > wheat flour> pounded yam. The significant decrease ($p< 0.05$) in the carbohydrate content of pounded yam observed as compared to all other food samples analysed may be as a result of high moisture content of the food. Hence it may has short shelf-life because the moisture content can provide an enabling environment for the growth of microorganism which will enhance their spoilage. The significant reduction in the moisture contents of all other samples as compared to pounded yam may give them longer shelf-life and account for their longer storage unlike pounded yam. All the food samples analysed are good sources of carbohydrate as portrayed by the result.

Semovita has the highest protein content while cassava is the least in percentage by mass of protein as compared with other food samples studied. The difference in the protein values of all these food samples is significant ($p<0.05$) with semovita having highest protein content followed by wheat flour, corn flour, poundo yam, pounded yam and cassava flour contained the least of amount of protein. They are fairly good sources of protein except for cassava flour and pounded yam .The percentage by mass of protein in semovita, wheat flour and corn flour is sufficient for the metabolism of body of a health adult individual but the protein content of all the food samples studied is not sufficient for the protein requirements of a growing baby as their cells are actively dividing and proliferating.

There is no significant difference ($p> 0.05$) between the crude fibre content of the wheat flour and cassava flour being the highest. The concentration of the crude fibre of wheat and cassava flour was followed by corn flour, poundo yam, and semovita while pounded yam has the least crude fibre content. These food items can help improve bowel movement and reduce constipation especially, the wheat, corn and cassava flour.

Minerals are known for their vital roles in enhancing the proper utilization of food by both plants and animals (Abdel-Salam, 2010).The cassava flour has a significant ($p<0.05$) highest concentrations of all the mineral elements (Ca, Mg, Na, and Fe) analysed followed by wheat flour. Poundo yam has significant ($p<0.05$) least concentration of Ca, Mg, Na but pounded yam is the least in Fe concentration as compared to all other food samples. The differences in the concentrations of these mineral elements studied are significant ($p<0.05$) in all the food samples investigated. Low sodium content helps to regulate acid-base balance and prevent nerve and muscle contraction. High sodium content has been reported to induce hypertension (Mishra *et al*., 2018).

Research article

Table 1: Proximate Analysis of the Food Samples

Sample	Protein (%)	Carbohydrate (%)	Fat (%)	Crude fiber (%)	Ash (%)	Moisture (%)
Pounded yam	2.45±0.02[a]	27.62±0.09[a]	0.55±0.03[a]	0.13±0.01[a]	0.50±0.03[a]	69.25±0.38[a]
Poundo yam	7.85±0.03 [b]	82.70±0.05[b]	0.65±0.03[ad]	0.18±0.00[ab]	1.08±0.01[b]	7.55±0.03[b]
Semovita	16.30±0.06 [c]	68.67±0.08[c]	1.50±0.06[b]	0.21±0.01[b]	1.23±0.01[bc]	12.10±0.06[c]
Wheat flour	14.96±0.00 [d]	67.45±0.05[d]	2.07±0.04[b]	1.82±0.01[c]	2.10±0.03[d]	11.60±0.03[c]
Corn flour	14.05±0.03 [e]	69.83±0.10[e]	5.00±0.29[c]	1.63±0.01[d]	1.15±0.03[bc]	8.35±0.09 [d]
Cassava flour	1.03±0.04 [f]	78.53±0.08[f]	0.82±0.01[d]	1.90±0.03[c]	1.28±0.01[c]	16.45±0.09[e]

Values are expressed as means of three (3) replicates ± SEM (Standard Error of Mean). Values with different superscripts within the columns are statistically different (p<0.05).
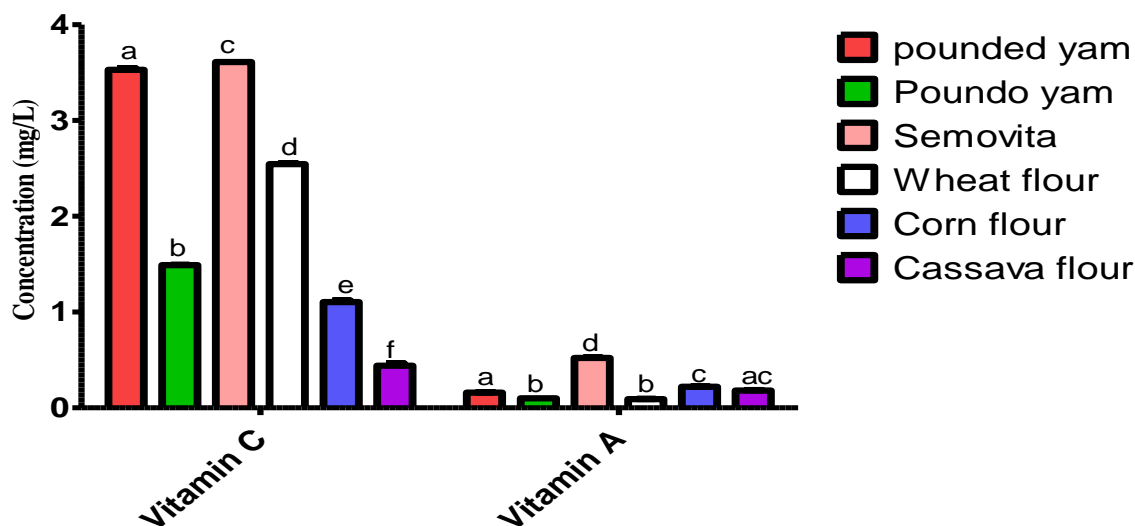

Figure 1: Vitamin A and C concentration of the various food samples.
Values are expressed as means of three (3) replicates ± SEM (Standard Error of Mean). Bars with different superscripts are statistically different (p<0.05).
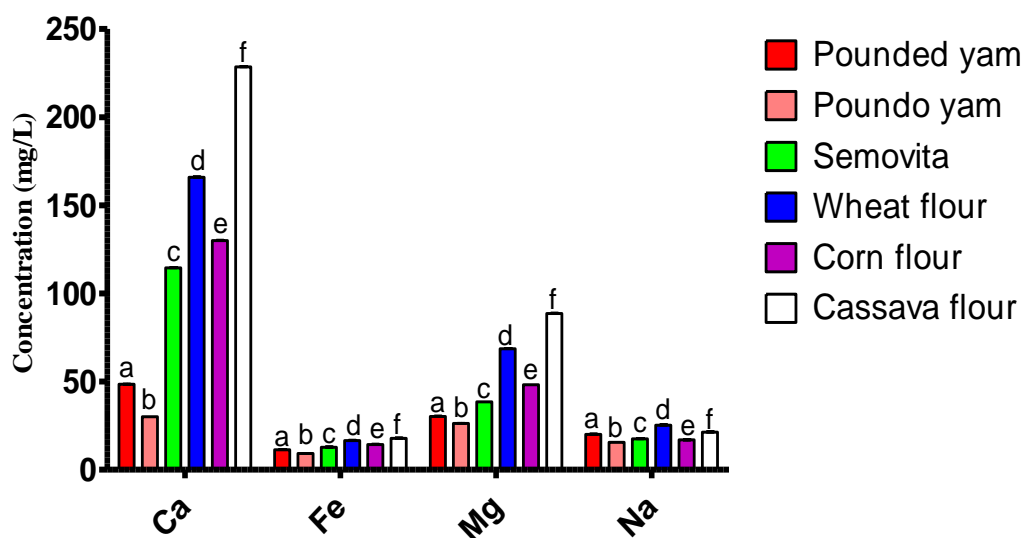

Figure 2: Mineral Elements concentrations of the food samples.
Values are expressed as means of three (3) replicates ± SEM (Standard Error of Mean). Bars with different superscripts are statistically different (p<0.05).

Magnesium (Mg) is essential for the structural stability of nucleic acid. A moderate level of Mg content will aid in the absorption of electrolytes in the body (Sissi & Palumbo, 2009).

Calcium (Ca) is needed for strong bone and dental formation: proper blood clotting and normal functioning of the nervous system. Deficiency of calcium has been reported to include rickets and decaying of the teeth. Excess calcium affects phosphorus usage in the body of animals, another final vital nutrient; hence, a moderate level is required for normal metabolism of the body of organisms.

In terms of the concentrations of vitamin A and C in these food samples, semovita has the significant (p<0.05) highest concentrations of both vitamins compared with other food samples. Cassava flour has the least concentration of vitamin C while wheat flour has the least concentration of vitamin A. from the results, all the food samples are richer in vitamin C compared to vitamin A, and hence they may be good sources

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of vitamin C which can provide significant amount of antioxidant against oxidants production from metabolism in the living system.

They are all very good sources of carbohydrate and calcium with cassava flour having the highest quantity of mineral elements studied. They are fairly good sources of protein except for cassava flour and pounded yam. Pounded yam is high in moisture content. This indicates that it can perish easily due to microbial attack. The food samples can't be eaten raw but it is first prepared with heating and can be consumed with the addition of other food supplements like vegetables and/or other legumes by young and old (children, adolescents, adults, pregnant and lactating mothers) for its high nutrients. These nutrients could significantly contribute to the body metabolic processes and refreshing it as well.

Poundo yam: The results of the percentage proximate composition of poundo yam showed it contained in a decreasing order of carbohydrate, crude protein, moisture, ash, crude fat, and crude fiber contents. The mineral content of poundo yam in a decreasing order comprised of calcium (Ca), magnesium (Mg), sodium (Na), and iron (Fe). It was also shown to contain moderate level of vitamin C. The result of this study is similar the report of Abiodun *et al.,* 2012 but in contrast with its protein and crude fiber contents. This report also showed a negative correlation with the company's claim on their label, this was also observed by; Adepoju and Oladejo, 2012; Joshua and Shuaeeb, 2012.

Semovita: The results of the percentage proximate composition of semovita showed it contained in a decreasing order of carbohydrate, crude protein, moisture, crude fat, ash and crude fibre. The mineral content of semovita in a decreasing order comprised of calcium (Ca), magnesium (Mg), sodium (Na), and iron (Fe). It was also shown to contain high level of vitamin C. The relationship between this study and that of the manufacturer's claim showed a positive correlation (0.888041) indicating that the analysis done in the laboratory agreed to a large extent with the manufacturer's claim.

Wheat flour: The results of the percentage proximate composition of wheat flour showed it contained in a decreasing order of carbohydrate, crude protein, moisture, ash, crude fat, and crude fibre contents respectively. Wheat flour is high in carbohydrate, protein and moisture content. The mineral content of wheat flour in a decreasing order comprised of calcium (Ca), magnesium (Mg), sodium (Na), and iron (Fe), respectively. It was also shown to contain high level of vitamin C. The relationship between laboratory analysis and its manufacturer's analysis gave a positive correlation showing that the analysis done in the laboratory agreed to a large extend to that of the manufacturer. The results gotten from the laboratory relates to a high extend with the work done by Senti and Rizek in 1975.

Corn flour: The results of the proximate composition of 100g of corn flour showed it contained in a decreasing order carbohydrate, crude protein, moisture, crude fat, crude fiber and ash contents respectively. Corn flour is high in carbohydrate, protein and moisture content. The mineral content of corn flour in a decreasing order comprised of calcium (Ca), magnesium (Mg), sodium (Na), and iron (Fe),

respectively. It was also shown to contain moderate level of vitamin C. Shaista Qamar *et al.* (2017) report was similar to a large extend to results gotten except for its mineral content which contrast the result significantly.

Cassava flour: The results of the proximate composition of 100g of cassava flour showed it contained in a decreasing order carbohydrate, moisture, crude fiber, ash, protein and crude fat contents respectively. Cassava flour is high in carbohydrate, moisture and crude fiber content. The mineral content of cassava flour in a decreasing order comprised of calcium (Ca), magnesium (Mg), sodium (Na), and iron (Fe), respectively. It was also shown to have the least quantity of vitamin C. The relationship between laboratory analysis and its manufacturer's analysis gave a positive correlation (0.994832) showing that the analysis done in the laboratory agreed to a large extend to that of the manufacturer.

4. Conclusion

The result of the study provides information on the nutritive value of different food samples. Result showed that they are rich in energy giving nutrients (carbohydrate and protein) and fairly high in fat. They are also rich in calcium, magnesium, sodium and preventive or protective nutrients (fiber and vitamins C). They contain a high amount of calcium which is essential for teeth and bone development, blood clotting and regulation of muscle contraction. They contained moderate quantity of sodium which can lead to decrease in blood pressure within days of beginning a specific diet.

These traditional and modernly refined foods could bring many benefits to people (young and old) in developing countries by playing important roles in providing food security, enhancing livelihoods, improving nutritional status and social well- being of vulnerable groups. Pounded yam, poundo yam, semovita, wheat flour, corn flour, and cassava flour could go a long way to alleviate problems of malnutrition and non -communicable diseases if consumed in adequate proportion with other classes of food.

Declarations
Competing Interest
The authors declare no competing of interest.

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