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Research Article

PROXIMATE ANALYSIS OF FOUR FOOD SECURITY LEGUMES FROM EASTERN NIGERIA

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Abstract

This study is aimed at evaluating the nutritional composition of pigeon pea (*Cajanus cajan*), African yam bean (*Sphenostylis stenocarpe*), wonderful kola (*Buccholzia coricea*) and Bambara nut (*Vigna subterranea*). Mature seeds of the four legumes were purchased from New Market in Aba, Abia State, Nigeria. A portion of each seed was dried and milled while the other portion was boiled before drying and milling. The proximate compositions were determined. The results showed that raw and cooked wonderful kola has the lowest and highest protein content respectively. Raw wonderful kola and cooked pigeon pea contained the lowest fibre while raw pigeon pea has the highest fibre content. Raw and cooked wonderful kola has the highest and lowest ash content respectively. Raw wonderful kola and raw Bambara nut have the highest and lowest moisture content respectively. Raw wonderful kola and cooked Bambara nut are very rich in fat while raw pigeon pea has the lowest fat content. Raw wonderful kola and raw Bambara nut have the least and highest carbohydrate content respectively. The result of this study showed that the four legumes are has high nutritional composition. Thus they could serve as food supplement.

Keywords: African Yam Bean, Bambara Nut, Pigeon Pea, Proximate composition, Wonderful Kola.

INTRODUCTION

Legumes are widely grown throughout the world especially as subsistence food crops and their dietary and economic importance are globally appreciated and recognized. Legumes not only constitute more than 30% of available protein in human diet in developing countries but adds variety to diet and also seen as an economical source of supplementary protein for a large human population (Agyeman *et al*., 2016). The primary nutritional importance of protein is that they are sources of amino acid in quantities corresponding to human requirement. Apart from being sources of proteins, legumes have been important sources of starch, oils, minerals, vitamins and health protecting compounds from the beginning of human history (Uchegbu *et al*, 2016). Their seeds play an important role in the traditional diet of many people of the world and are a valuable basic material for the food and animal feed industries. Legume seeds contain 200-250 g proteins/kg and the protein is rich in lysine and is therefore complementary to cereals in lysine balance. The main protein fractions are albumins and globulin. These fractions are different in their amino acid composition, molecular weight and physio-chemical properties. Pigeon pea (*Cajanus cajan*), African yam bean (*Sphenostylis stenocarpe*), wonderful kola (*Buccholzia coricea*) and Bambara nut (*Vigna subterranea*) are some of the edible legume grains which are underutilized and widely cultivated in the Southern Parts and western parts of Nigeria. Other parts of West African and Central Africa are also involved in cultivating these legumes (Klu *et al*. 2001). The African Yam Bean (AYB) also known as Okpodudu in the eastern part of Nigeria and Sheshe in the Western part of Nigeria is a perennial climbing bush crop, 1- 3m high, generally grown as an annual plant. Its leaves are trifoliate with oval leaflets (Klu *et al*., 2001). *Sphenostylis stenocarpa* is cultivated for its edible tubers, which looks like elongated sweet potatoes, and its seeds which are contained in hard and tough 20 – 30 long pods.

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Though mainly used and cultivated as food, it is also used to feed animals. *Sphenostylis stenocarpa* is native to tropical west and central Africa and is cultivated in Southern and Western Africa. It thrives on deep, loose sandy and loamy soils with good organic content and good drainage. It grows better in regions where annual rainfall ranges between 800 – 1400mm and where temperatures are comprised between 19 – 27^{o}C. The plant flowers after 90 days and the pods mature in 140 to 210 days. The tubers are ready to be harvested within 150 to 240 days after sowing. The seeds contain tannins, trypsin inhibitor, hydrogen cyanide, Saponin and phytic acid (Akinmutimi*et al*, 2006).

Figure 1. African yam bean (*Sphenostylis stenocarpa*)

Buccholzia coriacea belongs to the Capparaceae family. The seed gave the plant its common name of wonderful kola because of its popular usage in traditional medicine. The seeds are covered in a purple aril which is chewed in Ivory Coast and is known to have a sharp pungent taste. The plant *Buccholzia coriacea* has being documented to possess diverse medicinal potentials (Okoli *et al.,* 2010). It was reported that the plant

possessed some anti-plasmodial properties and that the grounded seeds were therefore routinely mixed with palm oil and taken orally as treatment for malaria (Okoli*et al.*, 2010).

Figure 2. Wonderful kola (*Buccholzia coriacea*)

Pigeon pea (*Cajanus cajan*) is a perennial legume of the family *fabaceace*. Since its domestication in South Asia at least 3500 years ago, its seeds have become a common food grain in Asia, Africa and Latin American. It is a valuable multipurpose drought tolerant crop that is grown for food in the tropics and sub-tropics of India, Africa, South-east Asia and Central America. The crop ranks sixth in the world, in the production of dryland legumes. Kenya is the main producer of pigeon pea in East – Africa and the second highest producer in the world after India. According to Amaefula and Obioha (2001), pigeon pea (*Cajanus cajan*) is commonly known as Achisharu in Hausa Language of Northern Nigeria where it is also produced in large quantities. In Igbo (Eastern Part of Nigeria), it is known as riorio (Amaefula and Obioha, 2001).

Figure 3. Pigeon pea (*Cajanus cajan*)

Bambara Nut (*Vigna subterranea*) also known by its common names Bambara groundnut, Bambara bean, Congo goober, earth pea, ground – bean or hog peanut is a member of the family *fabaceae*. The plant originated in West Africa. *Vigna subterrenea* ripens the pods underground, much like the peanut (also called groundnut).

Figure 4. Bambara nut (*Vigna subterranean*)

The name for Bambara nut differs from place to place. In Hausa Language it is variously referred to as "Gurjiya" or "Kwuru" (Airaodion *et al.,* 2021a). In the Ibo Language in Eastern Nigeria, it is commonly known as "Okpa" and in the Northern part of Yoruba, it is known as "Epa-Kuta". The origin of the Bambara groundnut is West Africa which includes Nigeria and other West African Countries (Airaodion *et al*., 2021b). The aim of this study is to evaluate the proximate analyses of *Sphenostylis stenocarpa, Cajanus cajan, Vigna subterranean* and *Buccholzia coricea*.

MATERIALS AND METHODS

Collection and Preparation of Samples

Matured seeds of *Buccholzia coricea* (Wonderful Kola), *Cajanus cajan (*Pigeon Pea), *Sphenostylis stenocarpa* (African Yam Bean), Bambara nut (*Vigna substerranea)* were obtained from New Market in Aba, Abia State and authenticated by Dr. E. S. Willie of the Department of Agronomy College of Crop and Soil Science, Michael Okpara University of Agriculture, Umudike, Nigeria. These seeds were selected properly and the defective ones were removed. The seeds of these samples were divided into two portions. One part of each sample was dried in the oven at a temperature of 40 ^{o}C, ground and stored in an air tight sample bottle. The other portions were boiled for 60 minutes, dried in the oven at 40 ^{o}C, ground and stored in a sample bottle for further analysis.

Proximate Analysis

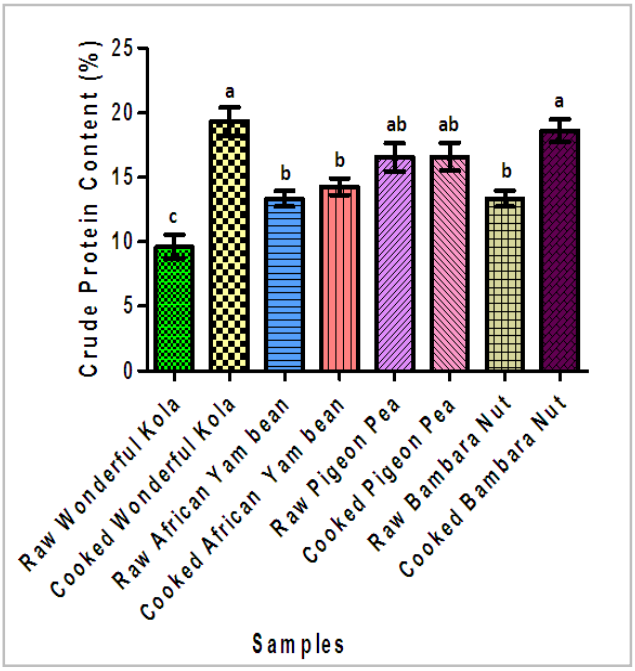
The proximate composition of samples was determined based on the standard methods of the Association of Official Analytical Chemists, (AOAC) 2010.

Statistical Analysis

Results are expressed as mean ± standard deviation. The levels of homogeneity among the groups were assessed using One-way Analysis of Variance (ANOVA) followed by Tukey's post hoc test. All analyses were done using Graph Pad Prism Software Version 6.00 and P values < 0.05 were considered statistically significant.

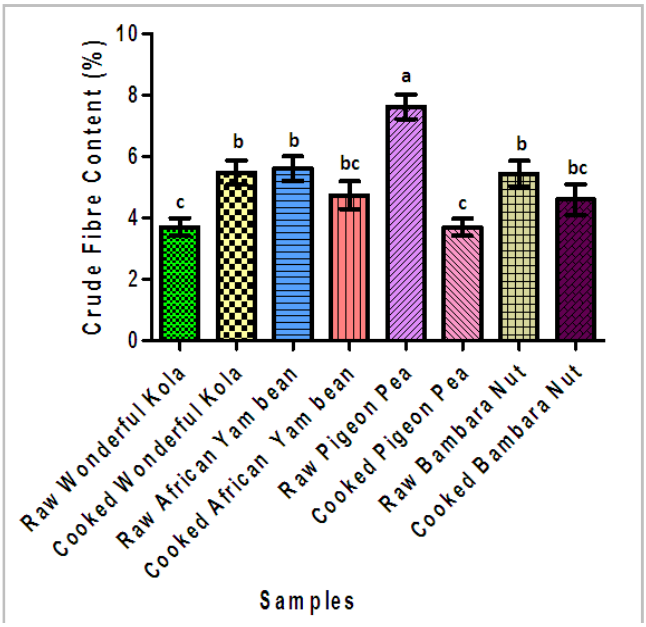
RESULTS

The results showed that raw and cooked wonderful kola has the lowest and highest protein content respectively (Figure 5). Raw wonderful kola and cooked pigeon pea contained the lowest fibre while raw pigeon pea has the highest fibre content (Figure 6). Raw and cooked wonderful kola has the highest and lowest ash content respectively (Figure 7). Raw wonderful kola and raw Bambara nut have the highest and lowest moisture content respectively (Figure 8). Raw wonderful kola and cooked Bambara nut are very rich in fat while raw pigeon pea has the lowest fat content (Figure 9). Raw wonderful kola and raw Bambara nut have the least and highest carbohydrate content respectively (Figure 10).



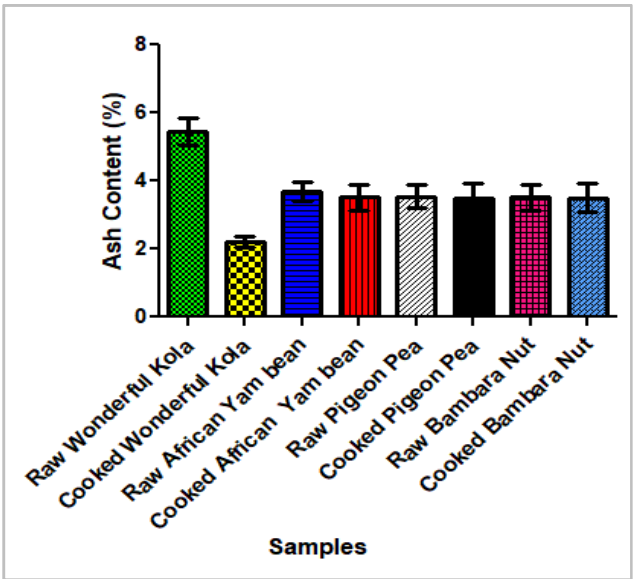
Results are presented as mean ±standard deviation with n = 3. Bars with different letters are significantly different at P<0.05.

Figure 5. Crude Protein Content of Samples



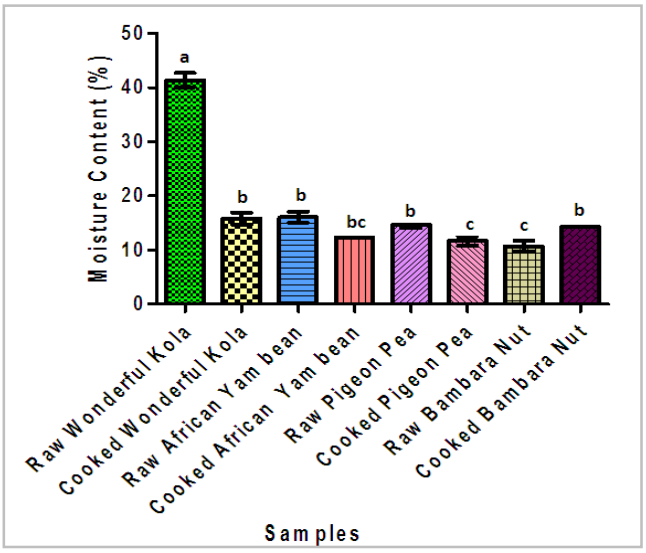
Results are presented as mean ± standard deviation with n = 3. Bars with different letters are significantly different at P<0.05.

Figure 6. Crude Fibre Content of Samples



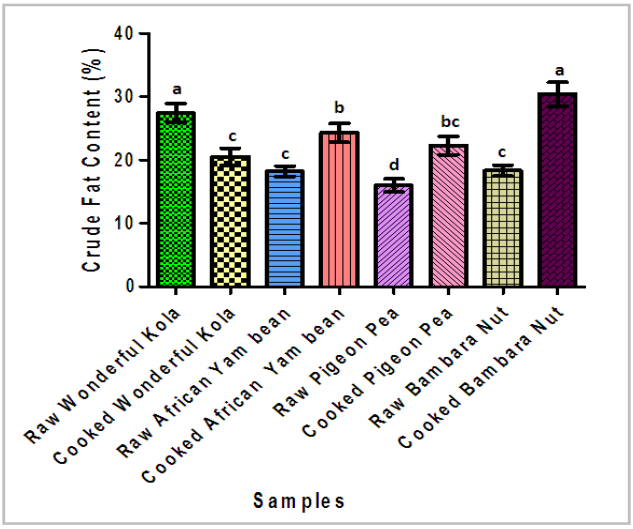
Results are presented as mean ± standard deviation with n = 3. Bars with different letters are significantly different at P<0.05.

Figure 7. Ash Content of Samples



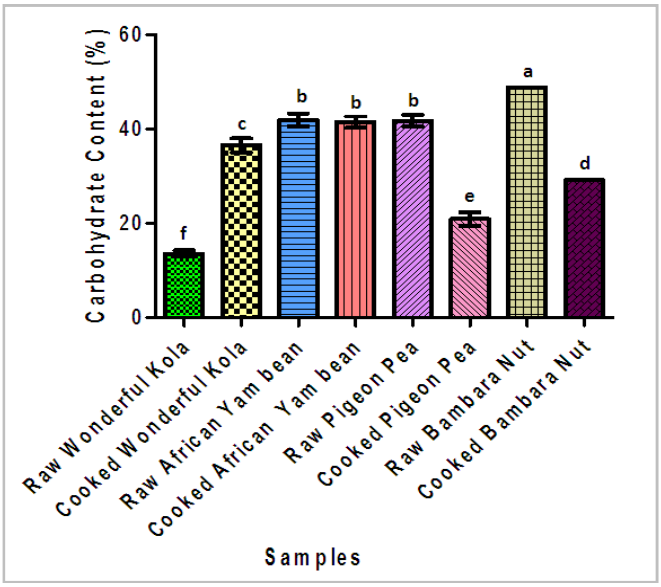
Results are presented as mean ± standard deviation with n = 3. Bars with different letters are significantly different at P<0.05.

Figure 8. Moisture Content of Samples



Results are presented as mean ± standard deviation with n = 3. Bars with different letters are significantly different at P<0.05.

Figure 9. Crude Fat content of Samples



Results are presented as mean ± standard deviation with n = 3. Bars with different letters are significantly different at P<0.05.

Figure 10. Carbohydrate Content of Samples

DISCUSSION

The results of the proximate analysis showed that both raw and cooked *B. coriacea, S. sternocarpa, V. subteranea*, and *C. cajan* contained protein, carbohydrate, fiber, ash, moisture and lipid as presented in figures 5-10. The percentage values of these nutrients in these legumes showed that their incorporation in foods as an additive can improve the nutritional composition of such foods. The protein percentage of these grain legumes except for raw *B. coriacea*, were in the range of the result reported for a number of common tropical legumes such as groundnut, cowpea by Kamath and Belavady, 2001. The protein values of raw pigeon pea, cooked wonderful kola, cooked Bambara nut and cooked pigeon pea were within the range reported by Ade-omowaye *et al.* (2015) in *V. subterranea* and *Mallotussubulatus*. Significant differences were not observed among raw African yam bean and raw Bambara nut. This indicates that these legumes can be used not only as meat replacements but also as components of rational nourishment and food for vegetarians in a large growing population. Being legume, the protein in the raw seeds of these samples are storage protein whose main protein fractions are albumin and globulin. Thus these legumes when consumed in combination with whole grains will make a complete (high quality) protein meal. The percentage fiber of raw and cooked samples of these four food security legumes *B. coriacea, S. sphenostylis, V. subteranea* and *C. cajan* were more than those of winged bean and jack bean reported by Chinedu and Nwinyi, (2011) except for Raw *B. coriacea*with percentage range of 3.72%, and cooked *C. cajan* with percentage range of 3.82% while that of lentil and limed bean were higher with percentage values of 33% and 15.0% respectively. The advantageous effect of these results may include, but not limited to an increase in fecal bulk and fecal moisture, reduction of plasma cholesterol level, improved GI, and reduced risk of colon cancer (Nwokolo *et al.*, 2000). This observation further suggests the potential food value of these underutilized legumes, which if included in diets could lower the risk of certain diseases and minimize food insecurity in developing nations like Nigeria. The percentage ash of these legumes used in this study was high. This suggests that these legumes could be good sources of some important minerals since the ash content is a reflection of the mineral element in a food material which can be estimated using atomic absorption spectrophotometer (Airaodion *et al.,* 2019). The total ash is also in particular important in the evaluation of the purity of drug i.e. the presence or absence of organic matter such as metallic salts or silica. Moisture content estimates directly the water content and indirectly the dry matter content of the sample. It is also an index of storage stability of the flour samples. Substances with moisture content less than 14 % can resist microbial growth and thus have better storability (Birk *et al*., 2006). The moisture content of these legumes was higher than the values obtained by Iqbal (2006) in raw ground nut seed. This result agrees with the range of values reported by Ade-Omowaye *et al*., (2015) for moisture content in *V. subteranea* and *Sphenostylis stenocarpa*. *C. cajan* from sudan was reported to contain 6.1% moisture which was lower compared to the values obtained in this present study. These variations in moisture content could be attributed to a number of variations in sample treatment such as storage factors before the laboratory analysis. This values observed in the moisture content could contribute positively to the shelf-life of these legumes and to their stability and prevents rancidity of their individual oil. The cooked legumes showed high crude fat content compared to the raw legumes with exception of raw *B. coriacea*. These values of fat in raw and cooked samples of *B. coriacea*, *S. stenocarpa, C. cajan* and *V. subteranea* were low compared to the that of raw, sundried and roasted groundnut reported by Iqbal (2006). The fat content suggests that these legumes could be suitable sources of nutrients that can improve the energy density of human and animals. The legumes exhibited high carbohydrate contents with exception of raw *B. coriacea and C. cajan*. These carbohydrate values in these legumes in general were low compared to the values obtained by Ibrahim and Fagbohun, (2012), with carbohydrate content in *Buchholziacoriacea* as 75% and high when compared to the carbohydrate content in Raw, sundried and roasted groundnut with values of 17.41%, 27.19% and 36.11% respectively reported by Iqbal (2006). This high carbohydrate content especially in raw *V. subteranea*, *raw S. stenocarpa*, raw *C. cajan* and cooked *S. stenocarpa* makes these legumes suitable and important energy source when consumed alone or in combination with other foods.

Conclusion

The result of this study showed that the four legumes are has high nutritional composition. Thus they could serve as food supplement.

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REFERENCES

Ade-Omowaye, B. I .O., Tucker, G. A., Smetanska, I. 2015. Nutritional potential of nine underexploited legumes in Southwest Nigeria. *Int. Food Res. J.,* 22 (2): 798-806.

Agyeman, J., Schlosberg, D., Craven, L. and Matthews, C. 2016. Trends and Directions in Environmental Justice: From Inequity to Everyday Life, Community, and Just Sustainabilities. *Annual Review of Environment and Resources,* 41(1):23-29.

Airaodion AI, Airaodion EO, Ewa O, Ogbuagu EO, Ogbuagu U. 2019. Nutritional and Anti–Nutritional Evaluation of

Garri Processed by Traditional and Instant Mechanical Methods. *Asian Food Science Journal*, 9(4): 1-13

Airaodion AI, Akunne PN, Njoku OC, Oladosu NO, Megwas AU. 2021a. Effect of Bambara nut on hepatic biomarkers of Wistar rats. *International Research Journal of Gastroenterology and Hepatology,* 4(1): 26-38.

Airaodion AI, Megwas AU, Njoku OC, Akunne PN, Oladosu NO. 2021b. Evaluation of methanolic extract of Bambara nut on renal indices of Wistar rats. *International Journal of Advances in Nephrology Research,* 4(1): 27-35.

Akinmutimi, A.H., Amaechi, N. P. and Unogu, M. 2006. Evaluation of Raw African Yam Bean Meal as Substitute for Soya Bean Meal in the Diet of Weaner Rabbits. *Journal of Animal and Veterinary Advances,* 5(11):907-911.

Amaefule, K.U. and F.C. Obioha, 2001. Performance and Nutrient utilization of broiler starters feed diets containing raw, boiled or dehulled pigeon pea seeds (*Cajanus cajan*). *Nig. J. Anim. Prod.,* 28: 31- 39.

AOAC 2010.Official Methods of Analysis.Association of Official Analytical Chemists.(20th edition), Washington D.C., U.S.A.

Birk, R., Bravado, B. and Shoseyov, O. 2006. Detoxification of cassava by *Aspergillus niger*. *Applied Microbiology and Biotechnology,* 45:411–414.

Chinedu S.N. and Nwinyi C.O. 2012.Proximate analysis of Sphenostylis stenocarpa and Voadzeia subterranean consumed in South – Eastern Nigeria. *Journal of Agricultural Extension and Rural Development,* 4 (3), 57- 62.

Ibrahim T.A. and Fagbohun E.D. 2012. Phytochemical and Nutritive Qualities of Dried Seeds of Buchholzia Coriacea, *Greener Journal of Physical Sciences,* 2(5): 185-191.

Iqbal A., Khalil,I. A., Ateeq N, Khan M.S 2006. Nutritional quality of important food legumes food chemistry, 97.331-335.

Kamath AV, Belavady B. 2001. Content and composition of dietary fiber in 117 frequently consumed foods. *J. Am. Diet Assoc.,* 92: 175- 286.

Klu, G. Y. P., Bansa, D., Kumaga, F. K. and Gamedoagbao, D. 2000. The African yam bean (*Sphenostylis stenocarpa*): A neglected crop in Ghana. *West African Journal of Applied Ecology,* 1(1): 142-149.

Nwokolo, E. 2000. A nutritional assessment of African Yam Beans and Bambara groundnut. *Journal Science food, Agriculture,* 14: 123-129.

Okolie, N. P., Falodun, A. and Davids, O. 2014. Evaluation Of The Antioxidant Activity Of Root Extract Of Pepper Fruit (DennetiaTripetala), And It's Potential For The Inhibition Of Lipid Peroxidation. *Afr J Tradit Complement Altern Med.,* 11(3):221-227.

Uchegbu, R.I., Akalazu, J. N., Ibe, C. O., Ahuchaogu, A. A. and Amadikwa, C. U. 2016. Chemical Composition of the Stem Extract of Costusafer (Bush Cane) and Its Antimicrobial Activity.*British Journal of Pharmaceutical Research.* 10(5): 1-9.

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