Communication In Physical Sciences 2018, 3(1):43-48 https://journalcps.com/

Comparison of the Proximate and Mineral Composition of two Cowpea Varieties obtained from Mile 12 Market, Lagos

Uduak .I. Aletan

Received 15 August 2018/Accepted 14 October 2018/Published online: 4 December 2018

Abstract *Vigna unguiculata (cowpea) is a species with different varieties available and consumed in Lagos Nigeria. This study was carried out to determine and compare the proximate and mineral composition of two of varieties, brown beans (Olo oyin) and white beans (big white beans) commonly sold in Mile 12 market, a local market in Lagos using standard methods. The result of the proximate analysis showed that the ash content of the brown bean variety (4.28 g/100 g) was significantly ($p < 0.05$) higher than that for the white bean variety (4.12 g/100 g). The crude protein content of the white bean variety (28.56 ± 0.16 g/100 g) was significantly ($p<0.05$) higher than that of brown bean (23.62 ± 0.9 g/100 g) variety studied. The brown beans was significantly ($p< 0.05$) higher in potassium (248.53 ± 0.50 mg/kg) than the white variety (241.12 ± 3.01 mg/kg).The level of calcium was significantly ($p< 0.05$) higher in the white bean variety (217.36 ± 4.01 mg/kg) than in the brown beans (188.35 ± 5.60 mg/kg). In these two varieties of cowpea studied the low levels of sodium in conjunction with the high level of potassium could mean that these legumes could be a good meal for hypertensive patients. The Ca: P in the two cowpea varieties studied are both within the range required to maintain calcium balance within the body. This is therefore the time to harness other potentials of these seeds.*

Key Words: *Vigna unguiculata*, Mineral composition, proximate composition, *Olo oyin*, big white beans

I. Aletan
Department of Pure and Applied Sciences, Faculty of Science, National Open University of Nigeria, Jabi Abuja.
Email address: ualetan@noun.edu.ng

1.0 Introduction

The nutritional value of any food or food materials can only be established through chemical analysis, which may involve analysis for proximate, mineral, toxicant, phytochemical and other constituents (Eddy and Ekop, 2005; Eddy and Udoh, 2005) *Vigna Unguiculata* (L) Walp, commonly known as cowpea is an edible leguminous plant (Ibrahim *et al.,* 2017) of the family Fabaceae (Singh *et al.,* 2003). It is cultivated primarily for seed, but also as a vegetable, cover crop and fodder. It is widely grown all over the world though it is perceived to have originated from Africa (Davis *et al.,* 1991). Nigeria is one of the world's prime producers of cowpea (Ogunlade *et al.,* 2014). Cowpea is one of the most important sources of protein in the diet of animals and man. It supplies more than half the plant protein in the diets in many developing countries (Aliyu and Wachap, 2014). In the absence of sufficient animal protein, cowpea serves as a major source of protein in Nigeria. (Alayande *et al*., 2012). Cowpea is starch-protein seeds contrary to some other legumes such as soya beans and groundnuts which are oil-protein seeds thus giving it a broader avenue of exploitation than any other legume in Africa (Alayande *et al.*, 2012). Cowpea is a main ingredient for many delicacies in various parts of Nigeria (Henshew *et al.,* 2000; Otitoju *et al*., 2015). Cowpeas are grown widely in savannah regions of the tropics and sub tropics, especially in western and central African countries (Alayande *et al*, 2012), thus most of the cowpea sold in Mile 12 market, Lagos are brought in from the Northern part of country where climatic conditions favour its cultivation. Mile 12 market is a major food market in Lagos. Various varieties of cowpea are sold in Mile 12 market. However, there is usually a preference for the brown variety commonly called *Olo oyin* (Honey beans*)* due to its unique slightly sweet taste.

Literature is scanty on comparative studies of various varieties of beans in Nigeria especially in the South. However, Alayande *et* al. (2012) found that both white and brown beans contain carbohydrate, protein, fibers and minerals such as calcium,

magnesium, potassium, sodium, iron, zinc, manganese and copper. The crude protein was found to be 15.62 and 17.91% with the brown seeds having the higher amount. The carbohydrate content analyzed was found to be 56.80 and 60.57% with the white seeds having the higher value. The crude lipid gave the least range which is 2.13 to 2.42%. The other parameters, moisture content, crude fiber and total ash contents were 3.56 to 5.08, 13.54 to 14.15 and 4.07 to 4.27%, respectively. However, their study did not include mineral composition analysis which are also essential components of nutrient tree (Margier *et al*., 2018). In order to compare the nutritional values of the two varieties of beans,

This study therefore seeks to carry out a comparison between the proximate and mineral composition of the *Olo oyin* and the white beans (commonly called the big white beans). In other to ascertain if there is any nutritional advantage between these varieties.

2.0 Materials and Methods

The two varieties (*Olo oyin* -honey beans and big white beans) of cowpea seeds were purchased from Mile 12 market in Lagos and taken to the laboratory in polyethylene bags. They were handpicked to remove damaged seeds, dirt and stones. The samples were ground into fine powder using an electric blender to ensure homogeneity and kept in an airtight container for further analysis. All the reagents used in this study were of analytical grade.

2.1 Proximate analysis

This was carried out according to the procedure of Association of Official Analytical Chemist (A.O.A.C., 2003) for the determination of Moisture, Ash, Crude fibre and Crude protein content. The carbohydrate was calculated by difference method (A.O.A.C., 2003) by subtracting the sum (g/100 g dry matter) of Crude protein, Crude fat, Ash and Crude fibre from 100 g.

2.2 Mineral analysis

For the mineral analysis, wet digestion of the samples was employed. **C**alcium, magnesium, zinc and iron were determined by atomic absorption spectrometry while potassium and sodium were determined by the use of flame photometry according to the methods of A.O.A.C (2003). Phosphorus was determined by vanadomolybdate colorimeteric method (Ologhobo and Fetuga, 1983).

2.3 Statistical Analysis

The data collected for each parameter were analyzed for their central tendencies (mean) using descriptive statistics, values were expressed as mean ± standard deviation of the observations. To ascertain whether significant differences existed ($p < 0.05$) in parameters between the two varieties Excel statistical formula T test was employed.

3.0 Results and Discussion

Tables 1 and 2 present, proximate and mineral compositions of the two varieties of cowpea seeds

Table 1: Proximate Composition of the two varieties of *V. unguiculata* studied

Proximate composition (g/100 g)	Brown Beans	White Beans
Ash	4.28 ± 0.05	4.12 ± 0.03
Moisture	9.79 ± 0.03	4.66 ± 0.08
Crude Protein	23.62 ± 0.90	28.56 ± 0.16
Crude Fat	1.20 ± 0.20	4.75 ± 0.15
Crude Fibre	6.93 ± 0.00	1.87 ± 0.06
Carbohydrate	54.16 ± 1.10	56.05 ± 0.25
Energy value (kcal/g)	326.52 ± 8.63	381.19 ± 2.99

*****Values are means of three determinations ± the respective standard deviations.***

Table 2: Mineral Content of the two varieties of *Unguiculate* studied

Mineral (mg/kg)	Brown Beans	White Beans
Sodium	25.07 ± 0.20	3.97 ± 0.10
Potassium	248.53 ± 0.50	241.12 ± 3.01
Calcium	188.35 ± 5.60	217.36 ± 4.01
Phosphorus	152.15 ± 1.40	157.09 ± 1.63
Magnesium	77.09 ± 0.60	78.04 ± 0.00
Iron	6.78 ± 0.00	8.32 ± 0.01
Zinc	5.92 ± 0.10	4.08 ± 0.20

*****Values are means of three determinations ± the respective standard deviations.***

From Table 1, it is evident that the honey beans-*Olo oyin* (brown beans) had higher values for ash (4.28 ± 0.05 g/100 g), moisture (9.79 ± 0.03 g/100 g) and crude fibre (6.93 ± 0.00 g/100 g) than the big white beans (White beans) which had values of 4.12 ± 0.03, 4.66 ± 0.08 and 1.87 ± 0.06 g/100 g respectively for the same parameters. The white beans however showed higher values for crude protein (28.56 ± 0.16 g/100g), crude fat (4.75 ± 0.15 g/100 g) carbohydrate (56.05 ± 0.25g/100 g) and caloric value (381.19 ± 2.99 kcal/g) than the brown

beans which had values of 23.62 ± 0.90 g/100 g, 1.20 ± 0.20 g/100 g, 54.16 ± 1.10 g/100 g, and 326.52 ±8.63 kcal/g respectively for the same parameters.

The ash content of the brown bean variety (4.28 g/100 g) was significantly ($p < 0.05$) higher than that for the white bean variety (4.12 g/100g), both values were however within the range of values reported by Alayande *et al.* (2012) which were between 4.24 and 4.07 g/100g .Famata *et al.*2012 carried out a similar study on different varieties of *V.unguiculata* and reported values ranging between 1.93 and 3.97 %. The results show that *V.unguiculata* is low in ash content. The two varieties of beans studied showed a moisture content ranging from 9.79 ± 0.03 g/100 g for the brown variety to 4.66 ± 0.08 g/100 g for the white beans. There was nevertheless no significant difference ($p < 0.05$) in the moisture content of the two varieties. The moisture content for the two varieties was lower than the range 11.50 to 14.50 % reported by Otitoju *et al.* (2015) for four varieties of *V. unguiculata* but in agreement with the results of Owolabi *et al.* (2012) 6.80 to 9.10 % and Alayande *et al.* (2012) 3.56 to 5.08 %. Having moisture content as low as observed in this study is an advantage because it ensures a long shelf life for these cowpea varieties. The crude protein content of the white bean variety (28.56 ± 0.16 g/ 100 g) was significantly ($p<0.05$) higher than that of brown bean (23.62 ± 0.9 g/100 g) variety studied. Olopade *et al.* (2017) obtained a similar result for crude protein content (23.48 %) of the brown variety *olo-oyin.* The values were however found to be higher than the values (between 15.62 and 17.91 %) reported by Alayande *et al.* (2012) but also in agreement with the report of Otitoju *et al.* (2015) whose values ranged between 21.02 and 26.90 %. Having the values recorded in this study as the crude protein content, substantiates the claim that cowpea is a good source plant protein and is used as the main source of protein especially among low income earners where animal protein is an unaffordable luxury(Santos and Boiteux 2013;Animasaun *et al.*2015; Elhardallou *et al.,*2015. There was no significant difference ($p < 0.05$) between the crude fat content of the white beans (4.75 ± 0.15 g/100 g) and the brown beans (1.20 ± 0.20 g/100 g). These values are also within the range reported by other researchers. Olopade *et al* (2017) reported a value of 1.86 % for *Olo-oyin,* Otitoju *et al*. (2015) in their report recorded values ranging from 2.96 to 3.25 %. All these value show that cowpea cannot be considered as an oil seed. Seeds are considered as oil seeds when their oil yield is greater than 17% (Adaramola *et al.,* 2016*)* thus cowpea is not an oil seed and therefore not suitable and economical for commercial production. The brown bean variety had a higher fibre content (6.93 ± 0.00 g/100 g) than the white bean variety (1.87 ± 0.06 g/100 g) although the difference was not statistically ($p< 0.05$) significant. The values were in agreement with the range of values reported by Otitoju *et al*. (2015) (3.77 to 7.01 %) and Owolabi *et al*. (2012) 3.46 to 4.88 % in their separate studies of different varieties of cowpea. However, the results of this study disagree with those of Alayande *et al*. (2012) who reported values of 13.54 and 14.15 % for brown and white beans respectively. The differences may be attributed to the differences in the methods of analysis employed. Based on the level of crude fibre obtained in this study, these two varieties of cowpea will not be considered as good sources of dietary fibre. The white bean variety had a significantly ($p <0.05$) higher carbohydrate content (56.05 ± 0.25 g/ 100 g) than the brown bean variety (54.16 ± 1.10 g /100 g). These results were within the range of the report of Otitoju *et al*. (2015) who recorded values 45.66 to 55.74 % for different varieties of cowpea. With a value of 381.19 kcal/g, the white bean variety is significantly ($p< 0.05$) higher in energy value than the brown bean variety (326.52 ±8.63 kcal/g). The energy value of food can be estimated from the level of crude protein, carbohydrate and crude fat present by multiplying the constituents by the factor, 4, 4 and 9 respectively. It can therefore be deduced that these two varieties of cowpea have high energy value.

Table 2 shows the level of some mineral elements present in the two varieties of *V. unguiculata* studied. From the table, potassium was found to be the element with the highest presence in the two varieties of beans studied having values of 248.53 ± 0.50 mg/kg and 241.12 ± 3.01 mg/kg in the brown and white bean variety respectively. Among the macro elements, sodium had the lowest value in both varieties with values of 25.07 ± 0.20mg/kg and 3.97 ± 0.10 mg/kg in the brown and white bean varieties respectively. Zinc level for the brown bean variety was 5.92 ± 0.10 mg/kg while the white bean variety had 4.08 ± 0.20 mg/kg.

Minerals are inorganic nutrients, ordinarily needed in small quantities from less than 1 to 2500 mg per day, depending on the mineral (Soetan *et al* 2010). The two cowpea varieties studied have been shown to be rich in some of these minerals. The brown beans were significantly ($p< 0.05$) higher in potassium (248.53 ± 0.50 mg/kg) than the white variety (241.12 ± 3.01mg/kg). This trend is in agreement with the study of Alayande *et al.* (2012). This study and other literatures (Alayande *et al.*2012; Famata *et al*.2013; Inobeme *et al.*2014) have shown that cowpea is rich in potassium. The brown beans had a higher sodium level (25.07 ± 0.20 mg/kg) than the white beans (3.97 ± 0.10 mg/kg). These values are in agreement with those of Osunbitan *et al.* (2016) who reported values between 5.73- 23.70 mg/kg for varieties of bean flour. Potassium and sodium are essential for life. Excess sodium blunts the ability of blood vessels to relax and contract with ease, and may also overstimulate the growth of heart tissue (HHP, 2009). Molecular pumps that pull potassium into cells push sodium out of the cell (HHP, 2009), in this way, potassium helps to lower blood pressure by balancing out the negative effects of salt (BPA,2008). In these two varieties of cowpea studied the low level of sodium in conjunction with the high level of potassium could mean that these legumes could be a good meal for hypertensive patients. The level of calcium was significantly ($p< 0.05$) higher in the white bean variety (217.36 ± 4.01 mg/kg) than in the brown beans (188.35 ± 5.60 mg/kg).Phosphorus was also significantly higher ($p < 0.05$) in the white bean variety (157.09 ± 1.63 mg/kg) than in the brown bean variety (152.15 ± 1.40 mg/kg). Humans and other vertebrates require large amounts of calcium for production and repair of bone and normal function of nerves and muscles while phosphorus is an important constituent of adenosine triphosphate (ATP) and nucleic acid and is also essential for acid-base balance, bone and tooth formation (Soetan *et al*. 2010). Calcium: Phosphorus ratio (Ca: P) may be an important determinant of calcium absorption and retention because of the regulatory mechanisms, which control calcium and phosphorus homeostasis within the body (Bass & Chan, 2006). Animal studies have shown that low Ca: P diets cause low bone densities (Sax, 2001). Common practice is to have a Ca: P molar ratio between 1:1 and 2:1 (Koletzko *et al.*, 2005). This therefore implies that the Ca: P in the two cowpea varieties studied are both within the range required to maintain calcium balance within the body. Magnesium, zinc and iron are important co-factors found in the structure of certain enzymes and are indispensable in numerous biochemical pathways (Soetan *et al.,* 2010). There was no significant difference ($p < 0.05$) between the levels of magnesium in both varieties (77.09 ± 0.60 mg/kg for brown beans and 78.04 ± 0.00 mg/kg for white beans) of cowpea. There was also no significant difference ($p< 0.05$) between the levels of iron in both varieties of cowpea (6.78 ± 0.00 mg/kg for the brown variety and 8.32 ± 0.01 mg/kg for the white variety).However the level of zinc was significantly higher in the brown beans (5.92 ± 0.10 mg/kg) than in the white variety (4.08 ± 0.20 mg/kg).This finding is in agreement with the report of Alayande *et al.* (2012) who also reported a higher level of zinc in the brown beans than the white beans they studied.

4.0 Conclusion

The proximate and mineral composition of two varieties of beans (commonly called *Olo oyin* and big white) sold in Mile 12 market in Lagos state have been studied. The *Olo oyin* which is the brown bean variety studied was shown to have a significantly ($p< 0.05$) higher ash content, potassium and sodium content than the white variety (big white).

Conversely, the white bean variety was found to be significantly ($p<0.05$) higher in crude protein, carbohydrate content and energy value than the brown bean variety. The white bean variety was also found to be significantly ($p < 0.05$) richer in calcium, phosphorus and zinc than the brown bean variety.

However, there were no significant ($p < 0.05$) differences in the crude fibre and crude fat content as well as the levels of magnesium and iron in the two varieties. Therefore, though the brown bean variety is more appealing to taste, the white bean variety has higher nutrient contents.

5.0 Acknowledgement

The author is grateful to Mr. Sunday Adenekan of Biolife Consults and Mr. Daniel Achem for the technical assistance and Mr. Tunde Akinlabi for his participation in the study.

6.0 References

Adaramola, B., Onigbinde, A. & Shokunbi, O. (2016). Physiochemical properties and Antioxidant potential of *Persea Americana* seed oil. *Chemistry International, 2, 3, pp.* 168-175.

Alayande, L. B., Mustapha, K. B., Dabak, J. D. & Ubom, G. A. (2012). Comparison of nutritional values of brown and white beans in Jos North Local Government markets. *African Journal of Biotechnology* Vol. 11, 43, pp. 10135-10140

Aliyu, B. & Wachap, E. (2014) Vegetable cowpea as a source of cheap protein and an environmentally friendly crop for urban cities. WIT *Transaction on Ecology and the Environment,* 181*,* doi:10.2495/EID140261

Animasaun, D. A., Oyedeji, S., Azeez, Y. K., Mustapha, O. T. & Azeez, M. A. (2015) Genetic variability study among ten cultivars of cowpea (*Vigna unguiculata* L. Walp) using morpho-agronomic traits and nutritional composition. *Journal of Agricultural Sciences*, 10, pp. 119–130

AOAC (2003). *Official methods of analysis of the association of official's analytical chemists*, 17th editionn. Association of Official Analytical Chemists, Arlington, Virginia.

Bass, J. K., & Chan, G. M. (2006). Calcium nutrition and metabolism during infancy. *Nutrition Journal,* 22, pp. 1057–1066

Blood Pressure Association (2008). *Salt and blood pressure. Blood Pressure* UK http://www.bloodpressureuk.org/microsites/salt/Home/Whypotassiumhelps Retrieved 7th May 2018

Davis, D. W., Oelke, E. A., Oplinger, E. S., Doll, J. D., Hanson, C. V. & Putnam, D. H.(1991). *Cowpea Alternative Field crop Manual* https://hort.purdue.edu/newcrop/afcm/cowpea.html Retrieved 20th January 2018

Eddy, N. O. & Ekop, A. S. (2005). Comparative studies of the level of toxicant in the seeds of *Terminalia catappa*(Indian almond) and *Coulaedulis* (African walnut). *CHEMCLASS Journal* 2, pp. 14-76.

Eddy, N. O. & Udoh, C. L. (2005). Proximate evaluation of the nutritional value of some soup thickeners. *CHEMCLASS Journal*, 2, pp. 12-14.

Famata, A. S., Modu, S., Mida, H. M., Hajjagana, L., Shettima, A.Y. & Hadiza, A.(2013). Chemical composition and mineral element content of two cowpea (*Vigna unguiculata* l. walp.) varieties as food supplement *International Research Journal of Biochemistry and Bioinformatics 3*(4) pp. 93-96.

Harvard Health Publishing (2009). Potassium *and sodium out of balance*. Harvard Medical School

Henshaw, F. O., Uzochukwu S. & Bello, I.Y. (2000). Sensory properties of akara (fried cowpea paste) prepared from paste stored at low storage temperatures*" International Journal of Food Properties 3*, 2, pp. 295-304

Ibrahim S.V. K, Satish S, Ajay K. & Karunakara H. (2017) Pharmacological activities of *Vigna unguiculata* (L) Walp: A Review *International Journal of Pharma and Chemical Research* ,3, 1, pp. 44-49

Inobeme, A., Nlemadim, A. B, P. A, Ikechukwu, G. & Ajai, A. I (2014). Determination of proximate and mineral compositions of white cowpea beans (*Vigna Unguiculata*) collected from markets in Minna, Nigeria. *International Journal of Scientific & Engineering Research,* 8, pp. 502-504

Koletzko, B., Baker, S., Cleghorn, G., Neto, U. F., Gopalan, S., Hernall, O.,Hock, Q. S., Jirapinvo, P., Lonnerdai, B., Pencharz, P., Pzyrembel, H., Ramirez-Mayans, J., Shamir, R., Yamashiro, Y. & Zong-Yi, D. (2005). Global standard for the composition of infant formula: recommendations of an ESPGHAN coordinated international expert group. *Journal of Paediatric Gastroenterology and Nutrition, 41,* 584–599.

Margier, M., George, S., Hafnaoui, N., Remond, D., Nowicki, M., Du Chaffaut, L., Amiotm M. & Reboul, E. (2018). Nutritional Composition and Bioactive Content of Legumes: Characterization of Pulses Frequently Consumed in France and Effect of the Cooking Method. *Nutrient,* 10, 11,1668. doi: 10.3390/nu10111668

Ogunlade, I., Ogunleye, R. T. & Osasona, I. (2014) Chemical Composition, Antioxidant Capacity and Total Phenolic Content of the Flours Obtained from Cow Pea (*Vigna ungualata*) Varieties Commonly Consumed in Nigeria. *Current Journal of Applied Science and Technology*, 4, 12, pp.1729-1735

Ologhobo, A., D. & Fetuga, B., L. (1983) Investigation on the trypsin inhibitor, hema-gglutinin, phytic and tannic acid contents of

cowpea *Vigna unguiculata*. *Food Chemistry*, 12, 4, pp. 249-254.

Olopade, O. B., Odeniyi, I. A., Iwuala, S. O., Kayode, O. O., Fasanmade, O. A., Ajala, M. O., Chimah P.O. & Ohwovoriole, A. E (2017). Comparison of glycemic indices of some local beans (*Vigna unguiculata* [Linn] Walp varieties) in Nigerians. *Journal of Endocrinology, Metabolism and Diabetes of South Africa, 22*, 3, pp. 51–55

Osunbitan, S. O., Taiwo, K. A., Gbadamosi, S. O. & Fasoyiro, S. B. (2016). Essential mineral elements in flours from two improved varieties of cowpea. *American Journal of Research Communication*, 4, 1, pp. 118-130

Otitoju, G. T. O., Otitoju O., Nwamarah J. U. & Baiyen, S. O (2015). Comparative Study of the nutrient composition of four varieties of cowpea (*Vigna unguiculata*) and their products (beans-based products. *Pakistan Journal of Nutrition*, 4, 9, pp. 540- 546

Owolabi, A.O., Ndidi, U. S., James, B. D. & Amune F. A (2012). Proximate, antinutrient and mineral composition of five varieties (improved and local) of cowpea, *Vigna unguiculata*, commonly consumed in Samaru Community, Zaria-Nigeria. *Asian Journal of Food Science and Technology* 4, 2, pp. 70-72

Santos, C. A. F. & Boiteux, L. S. (2013). Breeding biofortified cowpea lines for semi-arid tropical areas by combining higher seed protein and mineral levels. *Genetic and Molecular Research*, 12, pp. 6782–6789

Sax, L. (2001). The Institute of Medicine's "Dietary eference Intake" for phosphorus: a critical perspective. *Journal of the American College of Nutrition,* 20, pp. 271–278.

Singh, B., Ajeigbe, H. A., Tarawali, S.A, Fernandez-Rivers, S & Abubakar, M. (2003). The production and Improving the production and utilization of cowpea as food fodder. *Field Crops Research,* 84, pp. 169-150

Soetan, K. O., Olaiya C. O. & Oyewole, O. E. (2010). The importance of mineral elements for humans, domestic animals and plants: A review. *African Journal of Food Science*, 4, 5, pp. 200-222.