COMPARATIVE NUTRITIONAL COMPOSITIONS OF *Irvingia gabonensis* (WILD BUSH MANGO) SEEDS AND *Abelmoschus esculentus* (OKRA) PODS

*Ndamitso, M. M. [1]; Mathew J. T.[1]; Shaba, E. Y.[1]; Salihu A.B. [2] and Ogunmiloro, O. J.[1]
[1]Department of Chemistry, Federal University of Technology, Minna, Nigeria
[2]Science Laboratory Technology, Federal Polytechnic Bida, Niger State.
[*]**email**: johntsadom@gmail.com

ABSTRACT

The comparative study on selected nutritive values of Irvingia gabonensis seeds and Abelmoschus esculentus pods was carried out using standard methods. The results of the proximate analysis showed that both plants are good sources of carbohydrate and protein while their functional properties showed that they had close to neutral pH values. Thus, their inclusion in food formulation may not influence the pH of the food product. It was also observed that Abelmoschus esculentus was more viscous than Irvingia gabonensis. Therefore the former can be preferably used for soup thickening due to its greater draw ability. Furthermore, Abelmoschus esculentus seeds contained higher potassium (3600.01±2.00mg/kg) and magnesium (2300.11±1.05mg/kg) values than Irvingia gabonensis (1152.32.±2.00 and 1170.03±1.02mg/kg respectively). In addition, Abelmoschus esculentus had higher iron (40.05±1.02mg/kg) than Irvingia gabonensis (12.42±0.12mg/kg) seeds thus making it a better source of iron required for healthy bone. However, both of them can serve as good sources of the minerals involved in pH balance, regulation of heartbeat and blood pressure. The amino acid profiles of these plants showed that they were very rich in glutamic acid (14.40±0.21 and 13.18±0.12g/100g of protein) but poor in methionine (1.02±0.02 and 1.51±0.15g/100g protein) respectively for Irvingia gabonensis and Abelmoschus esculentus while among the essential amino acids, leucine was the highest (8.01±0.01 and 6.61g/100g protein respectively). Thus these values indicated that Irvingia gabonensis could be a better source of these essential amino acids than Abelmoschus esculentus.

INTRODUCTION

Nutritional scientists are concerned with the research and findings of new feeding materials in order to improve the overall quality of humankind's life. Most developed countries have advanced sufficiently in the science of nutrition and no longer have much nutritional problems. In developing countries like Nigeria, where the annual population growth rate is 2.5%[1], the situation is quite different. Therefore, there is need for increased nutritional research with the view to discovering new food supplements for both man and his livestock. Thus in order to meet the demand for nutritionally balanced food for the world's increasing population and relieve the intense pressure on land use and natural resources, plants used as food must be explored[2]. Towards this goal in Africa, it has been reported that over 4000 plant species have the potential of providing food for millions of urban and rural dwellers[3]. Since this is

not an exhaustive list, there is still need for the exploration of other non-conventional sources in order to surmount the ever increasing human nutritional problems.

Irvingia gabonensis (wild bush mango) is a bush plant that produces seeds called *dika*, locally known as ogbono in Ibo, oroapon in Yoruba and magoron kurmi in Hausa. It is cultivated mainly for these seeds while the leaves and stem bark are used in traditional African medicine against fever and stomach ache[4]. Also, its roots, leaves and stem bark are mixed with palm oil for the treatment of diarrhoea[5]. It is also reported to have been administered for the treatment of dysentery, hernias, yellow fever and poison[6].

Abelmoschus esculentus L. (Moench) on the other hand, is an economically important vegetable crop grown in tropical parts of the world[7]. It is cultivated as a garden crop as well as on large commercial farms. The ladies finger, as is also popularly called, is a plant of African origin although it is cultivated in the tropics, subtropics and even warm temperate areas of the globe[8]. It is known as "ila" in Yoruba, "kubewa" in Hausa and "okwale" in Igbo[9]. In Nigeria, the West African okra is reported to grow naturally, especially in the marginal lands along roadsides, backyard farms and wastelands[10]. In general, *Abelmoschus esculentus* is a prominent fruit and leafy vegetable grown for domestic consumption most especially for its mature pods[9]. Although Kolawole *et al*. [9] opined that most of its cultivation is done during the dry season as a follow up crop to early maize cultivation especially in the South West Nigeria, it is also grown in the rainy season in most parts of Niger State.

The aim of this study was to compare the chemical as well as functional properties of *Irvingia gabonensis* seeds *(ogbono)* and *Abelmoschus esculentus* (okra) pods which are two common soup thickeners used in Minna in order to establish the one of higher nutritional advantage.

MATERIALS AND METHODS

Source of Materials

The seeds of *Irvingia gabonensis* and *Abelmoschus esculentus* (okra) pods were obtained from Kure market in Minna, Niger State. Samples were purchased from fifteen (15) different areas in the market and mixed to achieve appropriate composite sampling process.

Sample Preparations and Treatments

The kernel of *Irvingia gabonensis* was obtained by cracking the shell to separate out the seeds from the shell. The seeds were collected and spread out on flat surfaces and dried in the laboratory under room temperature for two weeks for proper drying. After this, the samples were ground into fine powder using mortar and pestle. The pulverized samples were then stored in airtight polythene bags prior to the commencement of analysis.

Proximate Analysis

The standard analytical procedures for food analysis were adopted for the determination of moisture content, crude protein, crude fibre, percentage lipids, carbohydrate, acid insoluble ash and energy value as described by AOAC[11].

Minerals Analysis

Sodium and potassium were determined using Gallenkamp Flame analyzer, while calcium, magnesium, iron, manganese, zinc and copper were determined using Buch Model 205 Atomic

Absorption Spectrophotometer. Phosphorus level was determined by the phosphovanado molybdate colorimetric technique using

JENWAY 6100 Spectrophotometer as described by Pearson[12].

Amino Acid Contents

From each of the pulverized samples, 50.00g was defatted in triplicate with chloroform and methanol mixture in a ratio 1:1. From each of the defatted sample, 30.00g was put into a glass ampoule, 7 cm^3 of 6M HCl was added and oxygen expelled by passing nitrogen into the ampoule and was put in the oven at 105^0C for 22h, allowed to cool and filtered. The filtrate was then evaporated to dryness at 40^0C under vacuum in a rotary evaporator. The residue was dissolved with 5cm^3 acetate buffer (pH 2.0) and loaded into the amino acid analyzer (the Technicon Sequential Multi-sample Amino acid Analyzer). The tryptophan contents of the samples were determined by refluxing triplicate 0.05g with 25cm^3 of 4.2$moldm^{-3}$ NaOH solution for 24 hours in a vacuum. To each, 25cm^3 of distilled water was added and filterd into 100cm^3 volumetric flask and made up to the mark. The flasks were then screened properly from sunlight and kept for tryptophan determination[13].

Functional Properties

The bulk density, water/oil absorption capacity, wettability, gelatinization temperature, viscosity and pH determinations were carried out using the methods of AOAC[11].

RESULTS AND DISCUSSION

The results of the proximate analysis in Table 1 revealed that *Irvingia gabonensis* (wild bush mango) seeds contained lower moisture (3.70±0.11%) than *Abelmoschus esculentus* (okra) pods (5.52±0.07%) but these values were lower than the 88% moisture content reported for okra pods by Adewole and Ilesanmi[14]. It also had lower ash (2.49±0.43%), crude fibre (0.80±0.01%) and crude protein (7.03±0.11) than *Abelmoschus esculentus* pods whose values were 7.75±0.06, 9.46±0.12 and 14.10±0.02% respectively. In this study, the ash and crude fibre contents of the samples were lower than those reported by Adewole and Ilesanmi[14] but their crude protein values were higher than the 6.24% reported by the two authors above. However, these crude protein values were lower than the either the 20.08 or 23.68% crude protein values reported for Sobz Pari and Pujab-8 varieties of okra by Farooq *et al*., [15]. The crude fat, carbohydrate and calorific contents of *Irvingia gabonensis* were higher than those of *Abelmoschus esculentus* and the 25.45±2.07% crude fat value for *Irvingia gabonensis* in this study was higher than the 15.12% reported for okra pods by Adewole and Ilesanmi[14] but lower than the 70 and 65.46% fat reported by Thierry *et al*., [16] and Onimawo *et al*., [17] respectively for the kernels of *Irvingia gabonensis*. This study has indicated that the two soup thickeners had good calorific values and could be of high nutritional importance. The results also showed that both samples could be good sources of carbohydrate while *Abelmoschus esculentus* may be a better source of protein than *Irvingia gabonensis*.

Table 1: Results of the Proximate compositions of *Irvingia gabonensis* (wild bush mango*)* seeds *and Abelmoschus esculentus* (okra) pod (%).

Parameters	Samples *Irvingia gabonensis*	*Abelmoschus esculentus*
Moisture content	3.70±0.11[a]	5.52±0.07[b]
Ash content	2.49±0.43[a]	7.75±0.06[b]
Crude fibre	0.80±0.01[a]	9.46±0.12[b]
Crude protein	7.03±0.11[a]	14.10±0.02[b]
Fat (lipid)	25.45±2.07[b]	5.12±0.15[a]
Carbohydrate	60.56±0.81[b]	58.15±0.80[a]
Calorific value (kcal/100g)	499.29±0.12[b]	334.68±0.15[a]

Values in the same row bearing same superscripts are significantly not different at $p \geq 0.05$

The functional properties of the two samples as seen in Table 2 indicated that *Irvingia gabonensis* whose bulk density, water absorption capacity, viscosity and wetttability were 0.62±0.18g/cm^3, 44.00±2.00%, 16.07±0.46 min and 36.33±0.57% respectively were higher than those obtained for *Abelmoschus esculentus*. On the other hand, the oil absorption capacity of the latter (40.00±2.00%) was higher than that of the former (26.30%). However, it was observed that their pH values which were 6.62±0.01 and 6.49±0.06 respectively, did not differ significantly (at $p \geq 0.05$). These pH values indicated that both samples had close to neutral pH and that inclusion in food formulation would not influence the pH of their food products[18]. These pH values were slightly higher than the 5.8 reported for the seeds of *Irvingia gabonensis* by Onimawo *et al*., [17] and this indicated that these samples may be more prone to microbial attack than those of Onimawo *et al*., [19] . *Irvingia gabonensis* had a higher water absorption capacity (44.10±2.00%) than *Abelmoschus esculentus* (35.66±2.51%) but lower oil absorption capacity (26.30±2.00) than the latter (40.00±2.00%). These values meant that on the basis of industrial processing involving water, *Irvingia gabonensis* kernels can be more easily manipulated than *Abelmoschus esculentus* while those involving the use of oil will enhance the processing of the latter more than the former[20].

TABLE 2: The functional properties of *Irvingia gabonensis* (wild bush mango) seeds *and Abelmoschus esculentus* (okra) pod.

Parameters	Samples	
	Irvingia gabonensis	*Abelmoschus esculentus*
Bulk density (g/cm^3)	0.62±0.18^a	0.56±0.14^b
pH	6.62±0.01^a	6.49±0.06^a
Water absorption capacity (%)	44.10±2.00^b	35.66±2.51^a
Oil absorption capacity (%)	26.30±2.00^a	40.00±2.00^b
Viscosity (min)	16.07±0.46^b	5.12±0.15^a
Gelation temperature (^{0}C)	46.66±0.57^b	45.33±0.57^a
Wettability (secs)	36.33±0.57^b	29.66±1.52^a

Values in the same row bearing same superscripts are significantly not different at $p \geq 0.05$

The investigation of the mineral contents of the samples as shown in Table 3 revealed that *Abelmoschus esculentus* whose Na, K, Ca, Mg, P, Fe and Mn contents were 70.21±1.20, 3600.01±2.00, 24.08±1.12, 2300.11±1.05, 250.30±1.02, 40.05±1.02 and 1.20±0.10 mg/kg were higher than the 61.13±1.10, 1152.32±2.00, 15.06±0.13, 1700.03±1.02, 100.42±1.03, 12.42±0.12 and 0.84±0.12 mg/kg respectively obtained for *Irvingia gabonensis* seeds. However *Irvingia gabonensis* had higher copper (5.02±0.01mg/kg) and zinc (11.32±1.02mg/kg) than *Abelmoschus esculentus* whose values were 3.02±0.12 and 9.51±0.52 respectively. The 3600.01±2.00 mg/kg sodium content of *Abelmoschus esculentus* obtained in this study was higher than the 146.48 mg/kg reported by Adewole and Ilesaanmi[14] for okra pods although the 61.13±1.1.10 mg/kg obtained for okra pods in this work was lower. These mineral contents showed that From these results, it could be inferred that these two soup ingredients can serve as good sources of those minerals that play significant roles in several biological processes especially those involved in bone growth (calcium, phosphorus and magnesium) and formation of haemoglobin (iron)[21].

In Table 4, the amino acid profile of *Irvingia gabonensis* seeds and *Abelmoschus esculentus* pods were given which showed that the two samples are very rich in glutamic acid with the respective values of 14.40±0.01 and 13.18±0.02 g/100g of protein. The respective tryptophan values of the two samples (0.83±0.01 and

0.55±0.02g/100g of protein) for *Irvingia gabonensis* seeds and *Abelmoschus esculentus* pods were although their respective leucine contents of 8.01±0.01 and 6.59±0.15g/100 g of protein were high enough for them to play significant nutritional roles in foods having them as their constituents and this finding was in line with that of Fowomola[22].

TABLE 3: The mineral contents of *Irvingia gabonensis* (wild bush mango) seeds *and Abelmoschus esculentus* (okra) pod in mg/kg

	Sample	
Parameters	*Irvingia gabonensis*	*Abelmoschus esculentus*
Sodium	61.13±1.10[b]	70.21±1.20[a]
Potassium	1152.32±2.00[a]	3600.01±2.00[b]
Calcium	15.06±0.13[a]	24.08±1.12[b]
Magnesium	1700.03±1.02[a]	2300.11±1.05[b]
Phosphorus	100.42±1.03[a]	250.30±1.02[b]
Iron	12.42±0.12[a]	40.05±1.02[b]
Zinc	11.32±1.02[a]	9.51±0.52[b]
Manganese	0.84± 0.12[a]	1.20±0.10[b]
Copper	5.02±0.01[b]	3.02±0.12[a]

Values in the same row bearing same superscripts are significantly not different at $p \geq 0.05$

TABLE 4: The amino acid profiles of *Irvingia gabonensis* (wild bush mango) seeds *and Abelmoschus esculentus* (okra) pod in g/100g protein

Parameters	Samples	
	Irvingia gabonensis	*Abelmoschus esculentus*
Lysine	3.62±0.15[a]	4.32±0.02[b]
Histidine	2.31±0.01[b]	1.99±0.01[a]
Arginne	6.13±0.01[a]	6.30±0.02[a]
Aspartic acid	10.24±0.57[b]	7.56±0.41[a]
Threonine	3.29±0.25[a]	3.11±0.15[a]
Serin	3.04±0.25[b]	2.50±0.01[a]
Glutamic acid	14.40±0.01[b]	13.18±0.02[a]
Proline	3.23±0.03[b]	1.83±0.01[a]
Glycine	4.02±0.02[a]	4.19±0.18[a]
Alanine	3.27±0.03[b]	2.60±0.10[a]
Cystine	1.31±0.14[a]	1.51±0.15[a]
Valine	3.25±0.05[a]	3.31±0.15[a]
Methioline	1.02±0.02[a]	1.51±0.15[a]
Isoleucine	3.17±0.02[a]	3.27±0.03[a]
Leucine	8.01±0.01[b]	6.59±0.15[a]
Tyrosine	3.18±0.02[b]	2.52±0.01[a]
Phenylalanine	5.06±0.02[a]	5.06±0.02[a]
Tryptophan	0.83±0.01[b]	0.55±0.02[a]

Values in the same row bearing same superscripts are significantly not different at $p \geq 0.05$

CONCLUSION.

From the results of this study, the two samples are characterized by high protein contents and significant carbohydrate values. They are also relatively rich in K, Mg, P and Fe. However, the fruits of *Abelmoschus esculentus* are nutritious than the seeds of *Irvingia gabonensis* in terms of their mineral constituents. Therefore, the

former is likely going to give a higher nutritional advantage over the latter. In general, this study has shown that *Irvingia gabonensis* seeds *and Abelmoschus esculentus* pods can serve as good sources of nutrients needed for the healthy growth of man and his animals.

REFERENCES

1. APAC, (2011). African advisory committee, cited *in Introduction to the Economic Community of West African States,* Manuscripts Noetic Associates, Ltd., Abuja, Nigeria.

2. Hughes, J. (2009). Just famine foods. What contribution can underutilized plants make to food security? *Acta Horticulture*. 806:39-47.

3. Rubaihayo, E. B. (2002). *The contribution of indigenious vegetable to household food security*.IK Notes. 44:1-4.

4. Ayivor, J. E. (2011*).* Evaluation of Elemental Contents of Wild Mango (Irvingia gabonensis) Fruit in Ghana**.** *Advance Journal of Food Science and Technology* 5: 381-384.

5. Lesley, A., and Nick, B., (2000). *Irvingia gabonensis & Irvingia wombolu*. A State of Knowledge Report undertaken for The Central African Regional Program for the Environmentby Oxford Forestry Institute. Department of Plant Sciences, University of Oxford United Kingdom.

6. Ayuk, E. T. (1999). Uses, management and economic potential of Irvingia gabonensis in the humid lowlands of Cameroon. *Forest Ecology and Management* 113: 1 pp.1-9.

7. Adeoluwa,O. O., and Kehinde, O. B.(2011). Genetic variability studies in West African okra (*Abelmoschus caillei). Agricultural and biological Journal of North America.* 10:2151-7525.

8. Nilesh, J.; Ruchi, J.; Vaibhav, J. and Surendra J. (2011). A Review on: Abelmoschus esculentus (l.) Moench. *Pharmacia*, 1(3): 84-89

9. Kolawole, O.T., Abiona, F. E., Kolawole, S. O., Ayankunle, A. A., Olaniran, O. I. (2011). Effect of *momordica charantia* fruit extracts on normal and alloxan diabetic rat. *International Journal of Pharachology*.7(4), 532-535.

10. Adeniji, O. T., Kehinde, O. B., Ajala, M. O., and Adebisi, M. A., (2007). Genetic Studies on seed yield of West African Okra (*Abelmoschus caillei*). *Journal of Tropical Agriculture*, 45(1-2):36-41.

11. AOAC (Association of Official Analytical Chemisets), (2006). Official Method of Analysis of the AOAC (W. Horwiz Editor) Eighteenth Edition Washington D. C.

12. Pearson D (1973). *Laboratory Techniques in Food Analysis* (pp. 33-52). London:

13. Valoran P. H. and Jeffrey S. R. (2002). Direct determination of tryptophan using high performance anion-exchange chromatography with integrated pulsed amperometric detection. *Analytical Biochemistry*, 308(2): 204-209.

14. Adeoluwa,O. O., and Ilesanmi, P. S.(2011). Genetic variability studies in West African okra (*Abelmoschus caillei). Agricultural and biological Journal of North America.* 10:2151-7525.

15. Farooq A., Umer R., Zahid M. Tahira I and Tufail S. (2011).Inter-varietal variation in the composition of okra (Hibiscus esculentus L.) seed oil. *Pakistan Journal of Botany*, 43(1): 271-280.

16. Thierry J. N., Hilaire M. N., Felicite T. M., Jacques F. and Linder M. (2011). Irvingia gabonensis fat: nutritional properties and effects increasing amounts on the growth and lipid metabolism of young rats *Wistar sp* West and Central Africa. *Lipids Health Dis*. 10, 43.

17. Onimawo J. A., Oteno F., Orokpo G. and Akubor P. I. (2003). Physicochemical and nutritional evaluation of African bush mango (Irvingia gabonensis) seeds and pulp. *Plant Foods for Human Nutrition*, 58(3): 1-6.

18. Nwosu, J. N. (2010). The Effects of Processing on the Functional Properties of 'Oze' (*Bosqueia angolensis*) Seeds. *Pakistan Journal of Nutrition* 9 (8): 781-786

19. Kolawole, O. M., Ajiboye, A. E., Aturu, E. E., Anibijuwon, I. I., (2011). Effect of Solar Drying on the Proximate and Microbial Composition of Abelmoschus esculentus. *Journal of Microbiology and Biotechnology Research*., 1(1):71-81.

20. Sunday Y. G., Vitalis I. O. and Monday O. A. (1994). Chemical composition and fuctional properties of raw, heat-treated and partially proteolysed wild mango (*Irvingia gabonensis*) seed flour. *Food Chemistry*, 49(3): 237-243.

21. Burtis, C. A. and Ashwood, E. R. (2003).Tietz Fundamentals of clinical chemistry, 5th Butter-worths ed. Elsevier, India. 543 – 566.

22. Fowomola, M. A. (2010). Some Nutrients and Antinutrients Contents of Mango (*Magnifera indica*) Seeds. *African Journal of Food Science*. 4(8),472 - 476,