Journal of Bioprocessing & Biotechniques

Research Article Open Access

Evaluation of Egusi Melon (*Colocythis citrullus*) Accessions in Nigeria Using Proximate and Fatty Acid Analysis

Gado AA[1]*, Muhammad ML[1], Falusi OA[1], Adebola MO[1], Madaki FM[2] and Kolo JT[2]

[1]*Department of Plant biology, Federal University of Technology, Minna, Niger state, Nigeria*
[2]*Department of Biochemistry, Federal University of Technology, Minna, Niger state, Nigeria*

Abstract

Colocynthis citrullus is a species of melon, popularly called 'Egusi' in West Africa. It belongs to a large family called *Curcubitaceae*, which consist of 119 genera and about 925 species. In order to assess variations in nutritional value of Egusi Melon (*Colocynthis citrullus*) seeds, proximate and fatty acid composition of eight accessions of the crop were carried out. The accessions were selected from collections of family *curcubitaceae* made across Nigeria. The analyses of shelled Melon seeds were done using the standard Method of Association of Analytical Chemists. The data collected from the proximate and fatty acid constituents were used for Analysis of variance and Duncan multiple range test (DMRT) was used to separate the means. The results of the proximate and fatty acid composition showed significant differences ($p < 0.05$) among the different melon accessions. Accession NGR-NG-02 had highest value of ash (8.71%), crude fibre (6.43) and crude protein (35.37%) contents. The highest stearic (10.03%) and oleic (18.49%) values were recorded for NGR-NG-02 and NGR-NG-20 respectively. While the highest palmitic (61.33%) and linoleic (65.84%) values were recorded for NGR-NG-29. The high significant variation observed among the accessions could be an indication of high genetic diversity among Nigerian Egusi melon.

Keywords: Evaluation; Egusi Melon; Proximate; Fatty acid

Introduction

Colocynthis citrullus (L.) is another type of melon seed which is commonly called Egusi in West Africa. It is a member of the family *Curcubitaceae* and has 119 genera with about 925 species. It is one of the most important vegetable crops in the tropical, subtropical and Mediterranean zones of the world [1]. It is a native of Africa, which has perhaps been introduced to Asia, Iran and Ukraine [1]. Its common names include Egusi in Yoruba, agushi in Hausa, epingi or paragi in Nupe and eashi in Gwari. Melon seeds have been classified into different types according to the thickness of the seed coat and the flatness of the edges. They have also been divided into three groups based on oil extraction characteristics Oyolu, et al. [2]. The seeds usually are white or cream color and can be of different sizes Oyolu et al. [3]. In Nigeria the seeds are boiled in salted water, or the roasted seed are ground and added to meal. The vegetable oil extracted from the seeds is expensive and nutritious; this oil is used for cooking and cosmetics purposes and of interest to pharmaceutical industries Ayodele et al. [4]. The residue from the oil extraction is made into balls that are fried to produce local snack in Nigeria, or is used as cattle feed Schipper et al. [5]. In many parts of Africa, where farmers lack access to meat or dairy, the high oil and protein content can make an excellent dietary supplement Jacob et al. [6]. Egusi is a very good alternative to baby food, it used to avert malnutrition. Mixing of the powdered seeds with honey gives a milky substance that is used as substitute to breast milk.

Materials and Methods

Seed source

Seeds of eight accessions of Melon were obtained from Department of Plant Biology, Federal University of Technology, Minna, Nigeria. The seeds were collections from major growing States in Nigeria. The collections were made by a PhD student of the Department of Plant Biology

Proximate composition

The moisture content and the fat content were determined according to the procedures described by AOAC in 1990 [7]. while the ash content, crude fibre and crude protein were estimated using procedures described by Pearson et al. [8]. The nitrogen was estimated based on the Kjeldhal procedure and the percentage nitrogen was converted to crude protein by multiplying by a factor of 6.25 while carbohydrate was determined by simple difference as follows:

Carbohydrate=100- (% Ash + % Crude protein + % Crude fat + % Crude fibre)

All analyses were carried out in triplicates. All the proximate values were reported in percentage.

Fatty acid composition

Fatty acid methyl esters (FAMEs) were prepared as described by Joseph and Ackman [9]. FAMEs were transferred into a separating funnel and 4 mL of n-hexane added. The contents were shaken vigorously at room temperature and left to stand for 60 minutes. The hexane layer was collected and the aqueous layer was extracted again. The hexane fractions obtained were mixed together and washed with 3-4 portions of distilled water to remove acid present. Anhydrous sodium sulphate was added for dehydration purposes. The filtrate obtained was bubbled in nitrogen gas to concentrate it then about 0.5 mL was injected into the Gas Chromatography. The standard solutions were also injected and the procedure was repeated for all the samples as per AOAC in 2000 [10].

***Corresponding author:** Gado AA, Department of Plant biology, Federal University of Technology, Minna, Niger state, Nigeria, Tel: +2348036218125; E-mail: ayishatmoh@yahoo.com

Received October 05, 2019; **Accepted** December 10, 2019; **Published** December 17, 2019

Citation: Gado AA, Muhammad ML, Falusi OA, Adebola MO, Madaki FM, et al. (2019) Evaluation of Egusi Melon (*Colocythis citrullus*) Accessions in Nigeria Using Proximate and Fatty Acid Analysis. J Bioprocess Biotech 9: 346.

Data analysis

The data collected for proximate and fatty acid compositions in all accessions were subjected to one-way analysis of variance (ANOVA) using SPSS. Duncan Multiple Range Test (DMRT) was used to separate the means were significant differences exist**.**

Results

Proximate composition

The accession NGR-OS-25 had highest moisture content (8.37%) which was not significantly ($p>0.05$) different from that of NGR-OG-29 (7.33%) but differ significantly ($p<0.05$) from all other accessions. However, NGR-NG-02 had the least moisture (1.90%) content (Table 1). The accession NGR-NG-02 was generally high in ash (8.71), fat (45.12), crude fibre (6.43), crude protein (35.37) and carbohydrate (26.03) contents which in most cases were significantly ($P > 0.05$) different from those of other accessions (Table 1). Accession NGR-OS-25 was the least in fat (25.59) and carbohydrate (9.52) contents while NGR-KW-33, NGR-NG-01 and NGR-NG-02 were least in ash (2.23), crude fibre (2.22) and moisture (1.90) contents respectively (Table 1).

Fatty acid composition

The NGR-NG-02 and NGR-OG-29 had the highest stearic acid (10.53%) and palmitic acid (61.33%) contents respectively while the NGR-OS-25 was the least with in both stearic acid (7.07%) and palmitic acid (2.53%.) a mean value of 7.07% (Table 2). The highest value of oleic acid (18.49%) was observed in NGR-NS-20, which was significantly ($p<0.05$) different from that of all other accessions. Similarly, NGR-OS-25 had least mean value for oleic acid (9.0%). The accessions NGR-OG-29 and NGR-NS-20 had highest (65.84%) and least (50.99%) linoleic acid respectfully (Table 2).

Discussion

The high variation observed in proximate composition among the accessions could be ascribed to high genetic diversity among Egusi melon accessions. This can be supported by the findings of Olaniyi et al. Ndukauba et al. [11], who reported that high genetic variability exists among Egusi melon. This variation in proximate composition could be used as criterion for grouping of melon seeds [12]. This can be corroborated by the report of Abel et al. [13]. He stated that proximate analysis is well accepted as a criterion for nutritional evaluation of seeds and it also aids in classification. The least moisture content (1.90%) recorded in this research is below the lower limit (5.16) of range reported by Gado et al. [14] on curcubta seeds and that by Dangogo et al. [15] on *Gardenia aqualla* seeds. The low moisture content is important in improving shelf life of the crop. This can be supported by the findings of Jacob et al. [5], who reported that low moisture content in melon will help improve its life span. Though the upper limit (9.13) for ash content recorded was within recommended daily allowance, it was higher than those (4.8% and 6.99%) reported by Elinge et al. [16] and Bankole et al.[17] respectively. The high ash content in the sample indicates the percentage of inorganic mineral elements present in melon seeds. A high mineral element in foods helps in nerve function, muscles and for metabolism in human body. The crude fiber content was between 2.90% and 6.40%, the recommended daily allowance of fiber in children is 1.5% and 3.0% in adult. Melon seeds in this study can therefore be recommended as good source of fiber. The result of crude fiber obtained can be corroborated with the report of Gado et al. [14] on Curcubita seeds; 3.08-4.18% by Gado, et al. [14] but higher than those reported for four varieties of melon seeds, 1.66-2.16% Abiodun [18]. It is believed that fiber helps lower the risk of diabetes and heart diseases, it also helps in bowel stability and strength. The highest fat content (43.56%) recorded from this research is close to that (45.21%) reported by Abiodun and Adeleke [18] for four varieties of melon seeds, but lower than those (55.00% and 53.85%) reported by Edidiong and Ubong [19] for *citrullus vulgaris* and *citrullus lanatus* respectively. The protein content ranged between 23.39 and 37.40%, which was within the protein recommended daily allowance for adult (20-35%) and children (25-35%). This is comparable to those reported for *Colocynthis citrullus* seeds 28.63% [17] and *Cucurbita pepo* seeds, 27.48% [16]. The Carbohydrate value of the samples ranged 9.67 to 32.92%, which was far from recommended daily allowance (45-

Accession	Moisture	Ash	Fat	Crude Fibre	Crude Protein	Carbohydrate
NGR-FCT-15	3.61 ± 0.50^{bc}	5.53 ± 0.38^{b}	40.82 ± 1.29^{ab}	3.46 ± 0.31^{bc}	29.33 ± 0.66^{bc}	21.02 ± 0.59^{b}
NGR-OG-29	7.33 ± 0.88^{a}	2.93 ± 0.66^{cd}	24.00 ± 2.08^{e}	2.90 ± 0.10^{cd}	27.66 ± 1.45^{bcd}	25.70 ± 2.30^{a}
NGR-IM-44	2.06 ± 0.37^{bc}	5.49 ± 0.62^{b}	45.66 ± 2.33^{a}	3.50 ± 0.57^{bc}	31.33 ± 1.85^{b}	28.64 ± 1.17^{a}
NGR-KW-33	3.70 ± 0.35^{b}	2.23 ± 0.18^{d}	26.70 ± 0.88^{de}	2.86 ± 0.12^{cd}	23.70 ± 1.86^{d}	11.96 ± 0.57^{d}
NGR-NG-01	3.59 ± 0.32^{bc}	3.62 ± 0.11^{c}	32.66 ± 2.66^{cd}	2.22 ± 0.17^{e}	26.33 ± 1.20^{cd}	18.83 ± 0.60^{bc}
NGR-NG-02	1.90 ± 0.49^{c}	8.71 ± 0.35^{a}	45.12 ± 1.94^{a}	6.43 ± 0.23^{a}	35.37 ± 1.16^{a}	26.03 ± 0.57^{a}
NGR-NS-20	2.60 ± 0.39^{bc}	3.54 ± 0.05^{c}	36.06 ± 0.63^{bc}	3.96 ± 0.08^{b}	31.00 ± 1.00^{b}	16.90 ± 1.35^{c}
NGR-OS-25	8.37 ± 0.70^{a}	3.22 ± 0.11^{c}	25.59 ± 2.90^{e}	3.52 ± 0.28^{bc}	14.80 ± 0.56^{e}	9.52 ± 0.08^{d}

Values are means ± standard error, values followed by the same alphabet(s) in a column are not significantly different at P>0.05 tested by Duncan Multiple Range Test.

Table 1: Proximate composition of different melon accessions.

Accessions	Stearic	Palmitic	Oleic	Linoleic
NGR-FCT-15	9.23 ± 0.62^{bc}	51.03 ± 1.56^{b}	11.88 ± 0.17^{b}	55.59 ± 1.69^{ab}
NGR-OG-29	7.86 ± 0.52^{d}	61.33 ± 1.85^{a}	10.00 ± 0.10^{d}	65.84 ± 3.64^{a}
NGR-IM-44	10.03 ± 0.60^{ab}	38.33 ± 0.66^{c}	12.02 ± 0.06^{b}	60.72 ± 3.53^{ab}
NGR-KW-33	7.53 ± 0.17^{d}	35.13 ± 0.40^{cd}	12.07 ± 0.04^{b}	60.77 ± 5.43^{ab}
NGR-NG-01	7.63 ± 0.14^{d}	34.30 ± 0.65^{cd}	12.02 ± 0.06^{b}	62.76 ± 2.27^{a}
NGR-NG-02	10.53 ± 0.26^{a}	50.20 ± 1.90^{b}	10.95 ± 0.02^{c}	59.72 ± 3.34^{ab}
NGR-NS-20	8.33 ± 0.44^{cd}	51.03 ± 1.51^{b}	18.49 ± 0.28^{a}	50.99 ± 1.51^{b}
NGR-OS-25	7.07 ± 0.02^{d}	32.53 ± 1.22^{d}	9.07 ± 0.05^{e}	52.38 ± 0.18^{b}

Table 2: Percentage fatty acid composition in different melon accession.

65%) for adult and children. From this result, melon seeds cannot be considered a good source of carbohydrate compared to other sources such as cereals, which contain 65-75% carbohydrate. All the fatty acid composition determined were below recommended daily allowance (RDA) except stearic (10.03%) and oleic acid (18.49%) with RDA of 6.0% and 15% respectively. This suggests the melon accessions could be good source for RDA of stearic and oleic acid. The differences in fatty acid composition reported in this study could probably be due to variation in method of laboratory analysis and genetic variability. This can be supported by the findings of Karanja et al. [20-28] who reported that differences in fatty acid composition of Pumpkin could probably be due to variation in the harvesting season, geographical locations, method of laboratory analysis and genetic variability

Conclusion

From the nutritional analysis, the Egusi melon could serve a good source of fat, protein and crude fibre. In addition, the seeds are also good source of stearic and oleic acid. Theses accessions could go a long way in addressing problem of malnutrition in many parts of country.

References

1. Schippers RR (2000) African indigenous vegetables. An overview of the cultivated species. p: 221.
2. Oyolu C (1977a) Extraction rates and chemical composition of seed types in egusi (*Colocynthis citrullus* L.). Acta Horticultural 53: 287-290.
3. Oyolu C (1977b) A quantitative and qualitative study of seed types in egusi (*Colocynthis citrullus* L.). Tropical Science 19: 55-62.
4. Ayodele OJ, Shittu OS (2013) Cost-benefit analysis of melon (egusi) seed and seed- oil yield responses to phosphorus fertilizer application. International Research Journal of Agricultural Science and Soil Science 3: 152-155.
5. Shippers RR (2002) African indigenous vegetables: An overview of cultivated species, Natural Resources Institute, University of Greenwich, UK. p: 24-27.
6. Jacob AG, Etong DI, Tijjani A (2015) Proximate, Mineral and Anti-nutritional compositions of Melon *Citrullus lanatus* seed. British Journal of Research 2:142-151.
7. AOAC (Association of Official Analytical Chemists) (1990) Official methods of Analysis, Association of Official of Analytical Chemists. (15th edn), pp. 807-928.
8. Pearson D (1979) The Chemical Analysis of Foods. London: Churchill Livingston, UK.
9. Joseph JD, Ackman RG (1992) Capillary column gas chromatographic method for analysis of encapsulated fish oils ethyl esthers: A collaborative study. Journal of Official Methods of Analysis of Analytical Chemist International. 75: 488-506.
10. AOAC (Association of Official Analytical Chemists) (2000). Official Methods of Analysis. Association of Analytical Chemists. (17th edn). Inc, USA.
11. Olaniyi OO, Ogidi GO, Mbah EU (2011) Variance in yield and agronomic performance of egusi-melon (*Citrullus lanatus* Thumb.) genotypes. International Journal of Current Research 3: 49-52
12. Ndukauba J, Nwofia GE, Okocha PI (2015) Variability in Egusi-melon genotypes in Derived savannah Environment in south Eastern Nigeria. International Journal of Plant Research 5: 19-26
13. Abel TG (2007) Diversity study on seed quality traits of Ethiopian mustard (*Brassica carinata* A. Brown) among seed samples selected from Oromiya Regional State, Ethiopian assessed by proximate analysis. Addis Ababa.
14. Gado AA, Falusi OA, Adebola MO (2017) Proximate and Mineral Analysis of Selected Cucurbita Species in Nigeria. International Journal of Applied Biological Research 8: 192-198.
15. Dangogo SM, Muhammad A, Aliero AA (2011) Proximate, mineral and anti-nutritional composition of Gardenia aqualla Seeds. Achieves of Applied Sciences Research 3: 577-581.
16. Elinge CM, Muhammad A, Atiku FA (2012) Proximate, mineral and anti-nutritional composition of pumpkin (*Cucurbita pepo* L.) seeds extracts. International Journal of Plant Research 2: 46- 150.
17. Bankole SA, Osio A, Joda AO (2005) Effect of drying method on the quality and storability of *Colocynthsis citrullus*. African Journal of Biotechnology 4: 799-803.
18. Abiodun OA, Adeleke RO (2010) Comparative studies of nutritional composition of four melon seeds varieties. Pakistan Journal of Nutrition 9: 905-908.
19. Edidiong AE, Ubong ME (2013) Analysis of *Citrullus lanatus* seed oil obtained from southern Nigeria. Elixir Organic Chemistry 54: 12700- 12703.
20. Karanja, JK, Mugendi BJ, Khanis FM (2013) Nutritional composition of the pumpkin seed cultivated from selected region in Kenya. Journal of Horticulture Letters 3: 17-22.
21. El-Adawy TA, Taha KM (2001) Characteristics and composition of watermelon, pumpkin, and paprika seed oils and flours. Food Chemistry 49: 1253-1259.
22. Etong DI, Ayeni KE, Ajayi OO (2013) Physicochemical properties and Nutritional values of Melina fruit (Gmelina arboreal) and mango (Mangifera indica) seed. International Journal of Conservation Science. 6: 56-62.
23. Ardabili GA, Farhoosh R, Khodaparast HHM (2011) Chemical composition and physicochemical properties of Pumpkin Seeds (Cucurbita pepo Subsp. Pepo Var. Styriaka) Grown in Iran. Journal of Agricultural Science Technology 13: 1053-1063.
24. Abulude FO (2000) Chemical composition and nutritive values of *Carica papaya* and *Citrus sinensis* seeds. The Journal of Technological Science 4: 24-27.
25. Alege GO, Mustapha OT (2013) Assessment of genetic diversity in Nigeria sesame using proximate analysis. Global Journal of Bioscience and Biotechnology 2: 57-62.
26. American Oil Chemists Society (2003) Official Methods and Recommended Practices of the American Oil Chemists Society Method.
27. Lazos ES (1986) Nutritional, fatty acid, and oil characteristics of pumpkin and melon seeds. Journal of Food Science 51: 1382-1383.
28. Murkovic M, Hillebrand A (1999) Distribution of fatty acids and vitamin E content in pumpkin seeds (*Cucurbita pepo* L.) in breeding lines. Acta Horticulturae, 492: 47-56.