# Compositional Studies of Citrullus lanatus (Egusi melon) Seed

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**Citation**

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**Abstract**

Proximate, amino acid and mineral composition of Citrullus lanatus (egusi melon) flour were determined using standard analytical procedures. The proximate composition analysis of egusi melon showed that the seed contained (% dry weight): moisture (4.6±0.3), ash (3.7±0.1), ether extract (45.7±0.1), crude protein (23.4±0.2), crude fibre (12.0±0.1) and total carbohydrate (10.6±0.2). The result of the amino acid analysis showed that egusi melon seed contained good quantities (g/100g protein) of arginine (9.0), isoluecine (4.8), leucine (4.2), and phenylalanine (3.2) which are essential amino acids as well as glutamic acid (16.9) and aspartic acid (16.3).The mineral analysis (mg/100g) of the flour included: Na (13.0±0.2), K (96.1±0.4), Ca (28.2±0.2), Mg (31.4±0.2), Mn (1.7±0.1), Cu (0.4±0.1), Zn (1.2±0.1), Fe (1.3±0.2), and P (125.3±3.1). With this nutrient profile egusi melon compares favourably with the known protein rich foods such as soybean, cowpeas, pigeon peas and pumpkin.

## INTRODUCTION

Many plant proteins usually in the form of protein extracts or seed flours are being investigated and tested for new products such as low cost fabricated foods which are nutritious, attractive and acceptable to consumers just like conventional foods from meat, fish and dairy products (Lawhom and Cater, 1971; Lin et al., 1974; McWalters et al., 1976). Seeds have nutritive and calorific values, which make them necessary in diets. Research attention that are geared towards increasing utilization of plant protein sources for food use includes pumpkin (Olaofe et al., 1994), peanut (Khan et al., 1975), pigeon pea (Oshodi and Ekperigin, 1989), African yam bean (Adeyeye et al., 1994), and akee apple (Akintayo et al., 2002). The ultimate success of utilizing plant proteins as ingredients largely depends upon the beneficial qualities they impact to foods, which in turn depend largely on their nutritional and functional properties (Shadrach and Oyebiodun, 1999).

Citrullus lanatus (egusi melon) is the biological ancestor of the watermelon now found all over the world, but originated from West Africa . Egusi melon is a member of the Cucurbitaceae family. Unlike the common watermelon, whose flesh is sweet and red, the egusi melon's juicy flesh is pale yellow or green, and also tastes bitter. A creeping annual herb, the egusi melon has hairy stems, forked tendrils and three-lobed hairy leaves.

Comprising 50% oil and 35% protein (Jack, 1972), the seeds have both nutritional and cosmetic importance. The seeds contain vitamin C and B2, minerals, riboflavin, fat, carbohydrates and protein (Lazos, 1986). Despite the vast nutritional and medicinal significance of egusi melon, little detail on its amino acid and mineral composition is available to an international readership. This study is therefore aimed at investigating the proximate, amino acid and mineral composition of egusi melon seed flour obtained from a South- Western State of Nigeria . Such information may expand the scope of knowledge on the nutritional qualities and utilization of egusi melon flour outside the coast of West Africa .

## MATERIALS AND METHODS

Chemicals: All chemicals used were of analytical grade and were products of BDH Chemicals Ltd, Poole , England unless otherwise stated.

Collection and Preparation of Samples: Egusi melon seeds used for this study were obtained from a local market in Iwaro-Oka Akoko, Ondo State , Nigeria and were identified as Citrullus lanatus by a taxonomist in the department of Crop Science, Faculty of Agriculture, University of Benin , Nigeria . Seeds were screened to remove bad ones, shelled manually and further screened. The seeds were then dried to constant weight in an oven at 70 ° C, ground using

mechanical blender, put in an air-tight container and stored in desiccators for further analysis, some of the seeds was subsequently deposited at the herbarium of the faculty.

Proximate Composition Analysis: The proximate analysis of the samples for moisture, total ash and crude fibre were carried out in triplicate using methods described (AOAC, 1990). The nitrogen was determined by micro Kjeldahl method described by Pearson (1976) and the nitrogen content was converted to protein by multiplying by a factor of 6.25. Determination of crude fat/lipid content of the samples was done using Soxhlet (Cehmglass) type of the direct solvent extraction using petroleum ether (boiling range 60-80 ° C) as solvent. At the end of the extraction, the solvent was evaporated and the flask dried in the oven (at 60 ° C). Total carbohydrate content was estimated by 'difference'. All the proximate values were reported in percentage (%).

Amino acid analysis: 2g of egusi melon flour was defatted with chloroform/methanol mixture using Soxhlet extraction apparatus (Cehmglass) while the extraction lasted for 15 hours. Between 30-50g of defatted sample was weighed into glass ampoule. 7ml of 6M HCl was added and oxygen expelled by passing nitrogen into the ampoule. The sealed ampoule was put in an oven at about 110 ° C for 22 hours and later allowed to cool before the content was filtered.

The filtrate evaporated to dryness at 40 ° C under vacuum in a rotary evaporator. Residue was dissolved with acetate buffer (pH 2). The method of amino acid analysis was by ion exchange chromatography (FAO/WHO, 1991) using the Technicum Sequential Multi Sample Amino Acid Analyzer (TSM) (Technicum Instruments Corporation, New York ).

Mineral analysis: The mineral composition of the sample was analyzed by dry-ashing the samples at 550 ° c to constant weight and dissolving the ash in volumetric flask using distilled, ionized water with a few drops of concentrated HCl. Sodium (Na) and Potassium (K) were determined by using a flame photometer (Model 405, Corning, UK) using NaCl and KCl to prepare the standards. All other metals were determined by Atomic Absorption Spectrophotometer (Perkin – Elmer model 403, Norwalk CT , London ). Earlier, the detection limits of the metals had been determined according to Techtron (1975). The optimum analytical grade was 0.1 to 0.5 absorbance units with a coefficient of variation of 0.87 – 2.20%. The minerals content were reported as mg/100 g.

## RESULTS AND DISCUSSION

The proximate composition (on dry weight basis) of Citrullus lanatus (egusi melon) are as shown in Table 1. According to the results, the moisture content of egusi melon (4.6%) is low compared to those reported for legumes by Arkroyed and Doughty (1964) ranging between 7.0 and 10%. However, this value agrees closely with that reported earlier by Ige et al. (1984) for pumpkin seeds. The mean ash content value of 3.7% obtained for egusi melon in this study is a little bit above the range of 1.5 – 2.5% recommended for seeds and tubers for animal feed formulation by Pomeranz and Clifton (1981). On this basis, egusi melon could be considered not to be suitable for animal feeds. The ether extract (crude fat) content of 45.7% obtained for egusi melon in this study agrees closely with that reported by Ige et al. (1984) for varieties of melon oil seeds which ranged between 47.9 and 51.1% . Our value also agrees with that obtained for pumpkin seed (47.0%) (Fagbemi and Oshodi, 1991), it is however too high compared to that obtained for soybean (23.5%) (Paul and Southgate, 1980). With the high amount of crude fat obtained for egusi melon in this study, egusi melon could be regarded as an oil seed. Our results show that egusi melon has a crude protein content of 23.4%. This value compares favourably with those of protein rich foods such as soybean, cowpeas, pigeon peas and pumpkin with protein contents ranging between 23.1 and 33.0% (Olaofe et al., 1994). This protein value also falls within the recommended daily allowance for children (23.0 – 36.0 g) (NRC, 1989). The crude fibre content of egusi melon (12.0%) obtained in this study is high compared to those of legumes (5.0 - 6.0%) (Aremu et al., 2006). As observed from our result, egusi melon is low in carbohydrate (10.6%) compared to other legumes which have as high as 20.0-60.0% carbohydrate content (Arkroyed and Doughty, 1964).

### Figure 1

Table 1: Proximate Composition (% dry weight) of

| Composition | % by Weight |
|---|---|
| Moisture | 4.6 ± 0.3 |
| Ash | 3.7 ± 0.1 |
| Ether extract | 45.7 ± 0.1 |
| Crude protein | 23.4 ± 0.2 |
| Crude fibre | 12.0 ± 0.1 |
| Carbohydrate | 10.6 ± 0.2 |

Values are mean ± standard deviation of triplicate determinations

The amino acid analysis of egusi melon flour (g/100 g

protein) is shown in Table 2. The results show that arginine, glutamic acic and aspartic acid with 9.0, 16.9, and 16.3 g/100g protein respectively were the three most abundant amino acids in egusi melon. This observation is in close agreement with the report of Olaofe et al. (1994), Adeyeye (2004), and Aremu et al. (2006). In addition, our result shows that egusi melon could serve as a good source of essential amino acids such as arginine, isoleucine and leucine.

### Figure 2

Table 2: Amino acid composition (g/100 g protein) of Citrullus lanatus (egusi melon) seed flour

| Amino acid | Concentration (g/100g protein) |
|---|---|
| Histidine* | 2.0 |
| Alanine | 5.6 |
| Arginine* | 9.0 |
| Lysine* | 0.4 |
| Glycine | 2.2 |
| Serine | 2.4 |
| Threonine* | 3.1 |
| Methionine* | 0.3 |
| Aspartic acid | 16.3 |
| Isoleucine* | 4.8 |
| Leucine* | 4.2 |
| Glutamic acid | 16.9 |
| Proline | 3.2 |
| Phenylalanine* | 3.2 |
| Tyrosine | 2.2 |
| Valine* | 1.3 |
| Cystine | 1.1 |

* Essential amino acids

The results obtained for the mineral composition of egusi melon are shown in Table 3. From the results, P is the predominant mineral in egusi melon seed. This is not in agreement with the observations of Olaofe and Sanni (1988), and Aremu et al. (2005) that K was the most abundant mineral in Nigerian Agricultural products. K however ranked second in concentration to P in egusi melon as observed in this study. Na, Ca and Mg are other important minerals which are highly concentrated in egusi melon. The Na/K ratio of egusi melon is less than one. This, on the basis of the recommendation of Nieman et al. 1992) could suggest that egusi melon would be suitable for reducing high blood pressure. On the other hand, the Ca/P ratio of egusi melon is far less than one (0.2) thus its consumption is likely to reduce the intestinal absorption of calcium.

### Figure 3

Table 3: Mineral composition (mg/100 g) of egusi seed flour

| Mineral | Concentration |
|---|---|
| Na | 13.0 ± 0.2 |
| K | 96.1 ± 0.4 |
| Ca | 28.2 ± 0.2 |
| Mg | 31.4 ±0.2 |
| Mn | 1.7 ±0.1 |
| Cu | 0.4 ± 0.1 |
| Zn | 1.2 ±0.1 |
| Fe | 1.3 ± 0.2 |
| P | 125.3 ± 3.1 |

Values are mean ± standard deviation of triplicate determinations

### References

r-0. Adeyeye, E.I. (2004): The chemical composition of liquid and solid endosperm of ripe coconut; Oriental J. Chem., 20: 471 – 475.
r-1. Adeyeye, E.I., Oshodi, A.A. and Ipinmoroti, K.O. (1994): Functional properties of some varieties of African Yam Bean (Sphenostylis stenocarpa) flour. Int. J. Food Sci. Nutr, 45: 115 – 126.
r-2. Akintayo, E.T., Adebayo, E.A. and Arogundade, L.A. (2002): Chemical composition, physico-chemical and functional properties of akee (B sapida) pulp and sees flours. Food Chem., 77: 333 – 336.
r-3. AOAC. (1990): Official Methods of Analysis, 15 th edn. Association of Official Analytical Chemists, Arlington , VA.
r-4. Aremu, M.O., Olaofe, O. and Akintayo, T.E. (2006): A comparative study on the chemical and amino acid compostion of some Nigerian under utilized legume flours. Pak. J. Nutr., 5: 34 – 38.
r-5. Aremu, M. O., Olonisakin, A., Otene, J.W. and Atolaye, B.O. (2005): Mineral content of some agricultural products grown in the middle Belt of Nigeria, Oriental J. Chem., 21: 419 – 426.
r-6. Arkroyed, W.R. and Doughty, J. (1964): Legumes In human nutrition, Food and Agricultural Organization nutrition studies publication, 19.
r-7. Fagbemi, T. N. and Oshodi, A.A. (1991): Chemical composition and functional properties of full flat fluted

pumpkin seed flour. Nig. Food J., 9: 26 – 32.
r-8. FAO/WHO (1991): Protein quality evaluation. Report of Joint FAO/WHO Expert Consultant, FAO Food Nutrition paper; 51, FAO/WHO, Rome , pp: 19 – 21.
r-9. Ige, M.N., Ogunsua, A.O. and Okon, O.L. (1984): functional properties of the protein of some Nigeria oil seeds. Casophor seeds and three varieties of someNigeria oil seeds. Food Chem., 32: 822 – 825.
r-10. Jack, T.J. (1972): Cucurbit Seeds: 1. Characterizations and uses of Oils and Proteins. A Review, Economic Botany, 26(2): 135 -141.
r-11. Khan, M.N., Rhee, K.C., Rooney, C.W. and Cater, C.M. (1975): Bread breaking properties of aqueous processed peanut protein concentrates. J. Food Sci., 40: 580 – 583.
r-12. Lawhom, J.T. and Cater, C.M. (1971): Effects of processing methods and pH of precipitation in the fields and functional properties of protein isolates from glandless cottonseed. J. Food Sci., 36: 372 – 376.
r-13. Lazos, E.S. (1986): Nutritional, Fatty acid and Oil Characteristics of Pumpkin and Melon Seeds. J. Food Sci., 51(5): 1382.
r-14. Lin, R.U., Humbert, E.S. and Sosulki, F.W. (1974): Certain functional properties of sunflower meal products. J. Food Sci., 39: 368 – 370.
r-15. McWalters, U.H., Cherry, J.P. and Holmes, M.R. (1976): Influence of suspension medium and pH in functional and protein properties of defatted peanut meal. J. Agri. Foods Chem., 24: 517 – 519.
r-16. National Research Council (NRC) (1989): Recommended Dietary Allowance, 10 th edition, ational Academic Press Washington, D.C., USA.
r-17. Nieman , D.C. , Butter Worth, D.E. and Nieman, C.N. (1992): Nutritions: Wm. C. Brown Publisher Dubugue, p: 9.
r-18. Olaofe, O., Adeyemi, F.O. and Adediran, G.O. (1994): Amino acid and Mineral Composition and Functional Properties of Some Oil Seeds. J. Agri. Food Chem., 42: 878 – 884.
r-19. Olaofe, O. and Sanni,C.O. (1988): Mineral contents of Agricultural products. Food Chem., 30: 73 – 79.
r-20. Oshodi, A.A. and Ekperigin , N.M. (1989): Functional properties of pigeon pea flour (Cajanus cajan). Food Chem, 34: 187 – 191.
r-21. Paul, A.A. and Southgate , B.A.T. (1980): Mucance and Widdowson's Composition of Food, 4 th edition, Her Majesty's stationary office, London . Uk , pp: 227- 228.
r-22. Pearson, D. (1976): Chemical analysis of foods, 7 th edition, Church Hill Livingstone, London .
r-23. Pomeranz, A. and Clifton , D. (1981): Properties of defatted soybean, peanut, field pea and pecan flours. J. Food Sci., 42: 1440 – 1450.
r-24. Shadrach, O.A. and Oyebiodun, G.L. (1999): The physico-functional characteristics of starches from cowpea, pigeon pea, and yam bean. Food Chem., 65: 460-474.
r-25. Techtron, V. (1975): Basic Atomic Absorption Spectroscopy; A modern Introduction; Dominican Press Victoria , Australia , pp: 104 106

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