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Nutritional composition of *Colocynthis citrullus* and *Sesanum indicum* grown in obi local government area of Nasarawa state, Nigeria

Ibrahim Khalil Adam[1,2], Abdulrazak Aliyu Osoku[1] and Bello Aminu Bello[3]

[1]Department of Biochemistry & Molecular Biology, Nasarawa State University, Keffi Nigeria

[2]Centre for Plant Sciences, Faculty of Biological Sciences, University of Leeds, LS2 9JT, Leeds, UK

[3]Department of Food Science and Technology, Kano University of Science and Technology, Wudil, P.M.B 3244, Kano State.

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ABSTRACT

The challenge to feed the increasing world's population with nutritionally balanced food is enormous hence determining the nutritional value of food is highly valuable in order to ensure the status of food. In our study, we determined the carbohydrate, protein, lipid, ash, fibre, energy and moisture content of *Colocynthis citrullus* and *Sesanum indicum* consumed in Nigeria, particularly in Nasarawa State. The Na, K, Ca, Mg, P, Zn, Fe, Cr, Cd, Pb and Cu contents of the two samples were also determined. High contents of carbohydrate, proteins and fat of 11.89, 27.67, and 52.48%; and 12.58, 24.92 and 49.44% were found in *Colocynthis citrullus* and *Sesanum indicum* respectively. The mineral contents of the two seeds showed a relatively high content of some of the minerals.

Introduction

The problem of malnutrition in under developed world like Nigeria is very challenging due to the socio-economic status of the populace. *Colocynthis citrullus* 'melon', a member of the Cucurbitaceae family is a common oil seed in Nigeria; with its seed rich in proteins and oil. There is wide use of *Colocynthis citrullus* in food (soups), as thickening and gelling agent (Onyeike et al., 1995; Aviara and Ajibola, 2002). *Sesanum indicum* a member of the Tubiflorae order and Pedaliaceae family is one of the most popular oil crops in the world with high content of protein and fats thus highly nutritive; sesame have also being reported to have anti-oxidant activities. Various countries grow this crop among which is Nigeria. Sesame has various uses which include industrial applications such as pharmaceuticals, energy / biofuel (biodiesel) cosmetics, perfumery, soaps, paints and insecticides (Fariku et al., 2007; Kanu, 2011; Latif and Anwar, 2011; Uzun et al., 2008). Similarly, the biodiesel potentials of *Colocynthis citrullus* has also been reported owing to its desired characteristics as a biodiesel source (Giwa et al., 2010). Vegetable 'plant' proteins are being considered as alternatives to animal proteins. A lot of legumes and oil seed crops like melon and sesame have this potential (Moure et al., 2006). Thus, the determination of nutritional status of food is very important due to the food security and malnutrition issues.

The significant role played by mineral elements in various physiological and biochemical activities has been reviewed elsewhere. Iron is an essential constituent of haemoglobin and cytochromes. Calcium is a key component of bones and teeth; phosphorus is also a major constituent of bones, teeth and ATP. Sodium and potassium have homeostatic roles to regulate the internal environment. Magnesium, zinc, copper, and iron serve as cofactors of various enzymes; magnesium is a cofactor in carboxylases, oxdases and kinases. Copper is a cofactor in enzymes such as cytochrme C oxidases, catalases among others. Chromium may be required to maintain glucose balance in organisms. Zinc is a cofactor for dehydrogenases, phosphatases, superoxide dismutase, reductase and polymerases (DNA and RNA polymerases) (Soetan et al., 2010). Cadmium and lead are toxic heavy metals of great concern; cadmium is known to inhibit antioxidant enzymes and may lead to oxidative stress. Its toxicity affects liver, kidney, testis, heart, bone, eye and brain while lead is a known environment pollutant that is toxic with potential for carcinogenicity (Soetan et al., 2010).

The two oil seeds *Colocynthis citrullus* and *Sesanum indicum* are very popular and used by the people of Nasarawa State and Nigeria in general daily as food. Thus, this study was carried out to determine the nutritional and mineral composition of *Colocynthis citrullus* and *Sesanum indicum* indigenous to Nasarawa State, Nigeria.

Materials and methods

Sample Collection and Preparation

Colocynthis citrullus and *Sesanum indicum* seeds used for this study were obtained from Anagba farm in Obi Local Government Area of Nasarawa State, Nigeria. The seeds were washed to remove sand and other dirts; and were then dried in room temperature for two days. The samples were milled to constant weight in an oven at 700C, ground powdered samples were stored in an air-tight container and stored in desiccators prior to analysis.

Proximate analysis

The AOAC (1990) method was used for the determination of moisture content of the seed flours. In brief, 2g each of the powdered samples were weighed and used. Ash content was determined according AOAC (1990) method in a muffle furnace at 5600C to burn off all the organic matter. The fat content of the seed flours of the samples was determined using soxhlet extractor as reported by Makni et al., (2010). Kjeldahl method as described by Makni et al., (2010) was used to determine the protein content of the samples.

Tele:

E-mail addresses: ibrahimkhalil_adam@yahoo.com

The percentage nitrogen was converted to percentage protein using the conversion factor of 6.25. The fibre content was determined according to the AOAC (1990) method. The carbohydrate was evaluated as described by Makni et al., (1990) by difference (100 – crude fibre + crude protein + crude fat + ash content + moisture content) %. The energy content was calculated as described by Kanu et al., (2009); using Calculated metabolisable energy (kJ/100g) = protein x 17 + fat x 37 + carbohydrate x 17.

Mineral analysis

The AOAC method (1990) was used to determine the metal content of the samples using controlled atomic absorption spectrophotometer (AAS) Solar969. Potassium and sodium were analyzed using the flame photometer (Model 405, Corning, UK).

Results and Discussion

The results of the nutritional and mineral compositions of the Colocynthis citrillus and Sesamum indicum are presented in the two tables 1 and 2 below respectively.

The value of moisture content of Colocynthis citrullus obtained in this work is in agreement with that reported by Aviara and Ajibo (2002); and Onyeike et al. (1995). The crude fat content of the seeds analysed in this work is also consistent with the report of Onyeike et al., (1995) and Uruakpa and Aluko (2004) which reported the fat content of melon to be 53.23% and 52% of the total. Crude protein value of the melon seeds analysed in this work of 27.67% is in close agreement with that reported by Onyeike et al., (1995) of 26.3%; and Aviara and Ajibola (2002); Uruapka and Aluko (2004) of 28.4%. Our present work obtained the carbohydrate content of the melon seeds to be 11.89% which is close to that obtained by Onyeike et al., (1995) of 10.7%. The energy value obtained of 2614 kJ/100g (624.4 kCal/100g) is in agreement with that reported by Onyeike et al., (1995) of 523.83 and 632.43 kCal/100g for raw and heat-processed melons respectively. The crude fibre and ash content of the Colocynthis citrullus seeds of 2.3 and 2.29% respectively is consistent with the report of Badifu, (2001) of 2 and 3% for crude fibre and ash content respectively. The fibre content obtained for Colocynthis citrullus in our work is in agreement with the report of Uruakpa and Aluko, (2004).

The moisture and fat contents of Sesame from Obi in Nasarawa State, Nigeria of 5.6 and 49.44% respectively is consistent with results of Makni et al. (2010) of 5.48 and 45.22% respectively. High moisture content in food may promote microbial activities which lead to spoilage. The value of crude fat content and protein content of the Sesame seeds analysed in this work of 49.44 and 24.92% respectively are in close agreement with that reported by Latif and Anwar (2011) of 50.2 and 29.4% for fat and protein content of S. Indicum respectively. The crude fat value is also consistent that reported by Egbekun and Ehieze (1997); and Kanu, (2011) of 48.2 and 48.4% respectively. This is also close to fat content of 55.4% reported by Uzun et al. (2008); the protein content is also consistent with the report of Elleuch et al. (2009) of 25.77%. The value of ash content of our sample of 3.99% is consistent with 4.68% and 2.96% as reported by Elleuch et al. (2007) and Lopez et al. (2003) respectively. The protein content of the Sesame seeds obtained in the present work of 24.92% is in agreement with the report of Elleuch et al. (2009) of 25.77%. This is also consistent with that reported by Hahm et al. (2009) of 24.58 – 25.22%. The value of crude fibre obtained in our present work of 4.03% is also close to that of fibre in Sesame seeds of 3.6% (Egbekun and Ehieze, 1997) and 5.37% (Elleuch et al., 2009). The carbohydrate content of the sample calculated by difference is in agreement with that reported by Egbekun and Ehieze (1997); and Kanu, (2011). The energy value of our sesame extract is 1477.98 kJ/100g which is close to that reported by Ogungbele et al., (2005). Various researches have shown the nutritional composition of sesame seed to be; oil (44–58%), protein (18–25%), carbohydrate content of approximately 13.5% and ash value of 5% (Elleuch et al., 2007). This is consistent with our findings that are shown in table 1.0 and discussed above.

There are lots of variation on the mineral content of *Colocynthis citrillus* and *Sesamum indicum* reported to date. The values of calcium, zinc and copper 211, 8.0 and 2.0 mg/100g respectively obtained for *Colocynthis citrullus* are in agreement with the report of El-Adawy and Taha (2001) of 150, 10.6 and 2.1 mg/100g for calcium, zinc and copper respectively.

The compositions of Na, K, Ca, Mg, Zn, Fe and Pb in our sample (*Colocynthis citrullus*) are high compared to what has been reported by Akpambang et al. (2008). The levels of sodium, phosphorus, magnesium, iron, calcium and copper obtained in our work for *Colocynthis citrullus* is comparable to that reported by Sadou et al. (2007) of 11.9±5.3, 30±4.2, 210±47, 11.6±8.4, 569±196 and 5.1±1.7 mf/100g for Na, P, Mg, Fe, Ca and Cu respectively. The iron and copper content of melon analysed by us is close to that reported by Milovanović and Pićurić-Jovanović (2005) of 4.2 and 1.8 mg/100g for Fe and Cu respectively.

The sodium content of S. indicum of 16.0mg/100g is comparable with 15.28mg/100g and 16.4mg/100g reported by Elleuch et al., (2009): and Makni et al., (2010). The values of zinc, iron and copper of 3.0, 8.0, and 1.0 mg/100g respectively obtained for sesame in our work is consistent with that reported by Hahm et al., (2009) of 2.72, 6.19 and 0.98 mg/100g for zinc, iron and copper respectively. The copper content of the sesame seeds analysed in the present work of 1.0mg/100g is also comparable with the report of Elleuch et al., (2010) of 2.15 mg/100g The phosphorus content of our sesame of 10.0mg /100g is close to that reported by Kanu (2011) of 15.8 and 13.4 mg/100g. The iron content in our Sesame sample is comparable to the report of Bamigboye et al. (2010) of 4.46 and 3.08 mg/100g for whole and dehulled sesame seeds respectively.

Conclusion

The analysis on the two samples *Colocynthis citrullus* and *Sesanum indicum* carried out in our present work implies that they have good nutritional values due to the high content of the major nutrients, carbohydrate, proteins and lipids. We found that the *Colocynthis citrullus* analysed in our work has higher protein, fat content and energy values than *Sesanum indicum*. Our analysis also indicated that both *Colocynthis citrullus* and *Sesanum indicum* are good sources of the micronutrients that are required for biochemical and physiological processes in the living system.

References:

Akpambang V.O.E., Amoo I.A., and Izuagie A.A. (2008) Comparative compositional analysis on two varieties of melon (Colocynthis citrullus and Cucumeropsis edulis) and a variety of almond (Prunus amygdalus). Research Journal of Agriculture and Biological Sciences, 4: 639-642

AOAC, 1990 Official Methods of Analysis of the Association of the Official Analytical Chemists. Association of the Official Analytical Chemists Inc., VA, USA.

Aviara N.A., and Ajibola O.O. (2002) Thermodynamics of moisture sorption in melon seed and cassava. Journal of Food Engineering 55: 107–113

Badifu, G. I. O., (2001) Effect of Processing on Proximate Composition, Antinutritional and Toxic Contents of Kernels from Cucurbitaceae Species Grown in Nigeria. Journal of Food Composition and Analysis 14: 153-161

Bamigboye A.Y., Okafor A.C., and Adepoju O.T. (2010) Proximate and mineral composition of whole and dehulled Nigerian sesame seed. African Journal of Food Science and Technology 1: 071-075

Egbekun M.K. and Ehieze M.U. (1997) Proximate composition and functional properties of fullfat and defatted beniseed (Sesamum indicum L.) Flour. Plant Foods for Human Nutrition 51: 35–41

El-Adawy T. A., and Taha K. M. (2001) Characteristics and Composition of seed oils and flours. Food Chemistry 74: 47-54

Elleuch M., Besbes S., Roiseux O., Blecker C., and Attia H. (2007) Quality characteristics of sesame seeds and by-products. Food Chemistry 103: 641–650

Fariku, S., Ndonya, A.E., and Bitrus, P.Y. (2007) Biofuel characteristics of beniseed (Sesanum indicum) oil. African Journal of Biotechnology 6: 2442-2443

Giwa S., Abdullah L. C., and Adam N. M. (2010) Investigating "Egusi" (Citrullus Colocynthis L.) Seed Oil as Potential Biodiesel Feedstock. Energies 3: 607–618

Hahm T., Park S., Lo Y. M. (2009) Effects of germination on chemical composition and functional properties of sesame (Sesamum indicum L.) seeds. Bioresource Technology 100: 1643–1647

Kanu P. J., Sandy E. H., B.A. Kandeh J., Bahsoon J. Z., and Huiming Z. (2009) Production and Evaluation of Breakfast Cereal-Based Porridge Mixed with Sesame and Pigeon Peas for Adults. Pakistan Journal of Nutrition 8: 1335-1343

Kanu P. H. (2011) Biochemical Analyis of Black and White Sesame Seeds from China. Americal Journal of Biochemistry and Molecular Biology. DOI 10.3923/ajbmb.

Latif S., and Anwar F. (2011) Aqueous enzymatic sesame oil and protein extraction. Food Chemistry 125: 679–684

Lopez G., Flores I., Galvez A., Quirasco M., and Farres A. (2003) Development of a liquid nutritional supplement using a Sesamum indicum L. protein isolate. Lebensm.-Wiss. U.-Technol. 36: 67–74

Makni M., Fetoui H., Garoui E., Gargouri N. K., Jaber H., Makni J., Boudawara T., Zeghal N., (2010) Hypolipidemic and hepatoprotective seeds mixture diet rich in ω-3 and ω-6 fatty acids. Food and Chemical Toxicology 48: 2239–2246

Milovanović M. and Pićurić-Jovanović K. (2005) Characteristics and composition of melon seed oil. Journal of Agricultural Sciences 50: 41-47

Moure A., Sineiro J., Domınguez H., Parajo J. C. (2006) Functionality of oilseed protein products: A review. Food Research International 39: 945–963

Ogungbenle H. N., Oshodi A. A., Oladimeji M. O. (2005) Chemical energy evaluation of some under-utilized legume flours. Rivista Italiana Delle Sostanze Grasse 82: 204-208

Onyeike E. N., Olungwe T., and Uwakwe A. A., (1995) Effect of heat-treatment and defatting on the proximate composition of some Nigerian local soup thickeners. Food Chemistry 53: I73-I75

Sadou H., Sabo H., Alma M. M., Saadou M., and Leger C. (2007) Chemical content of the seeds and physico-chemical characteristic of the seed oils from Citrullus colocynthis, Coccinia grandis, Cucumis metuliferus and Cucumis prophetarum of Niger. Bull. Chem. Soc. Ethiop. 21: 323-330

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

Uruakpa F.O., Aluko R.E. (2004) Heat-induced gelation of whole egusi (Colocynthis citrullus) seeds. Food Chemistry 87: 349–354

Uzun B., Arslan C., Karhan M., Toker C. (2008) Fat and fatty acids of white lupin (Lupinus albus L.) in comparison to sesame (Sesamum indicum L.). Food Chemistry 1

Table 1.0: composition of *Colocynthis citrillus* and *Sesamum indicum* seed flours

Parameter (%)	*Colocynthis citrullus*	*Sesanum indicum*
Moisture Content	3.37 ± 0.3	5.6 ± 0.24
Crude Fibre	2.3 ± 0.2	4.03 ± 1.0
Crude Fat	52.48 ± 1.84	49.44 ± 0.24
Crude Protein	27.67 ± 0.3	24.92 ± 0.44
Ash Content	2.29 ± 0.2	3.89 ± 0.14
Carbohydrate	11.89 ± 2.35	12.58 ± 0.35
Energy (kJ/100g)	2614.28	1477.98

Values = mean ± standard deviation

Table 2.0: Mineral content (mg/100g) of *Colocynthis citrillus* and *Sesamum indicum* seeds

Mineral Element	*Colocynthis citrullus*	*Sesanum indicum*
Na	13.0	16.0
K	12.0	7.0
Ca	211.0	171.0
Mg	110.0	81.0
P	16.0	10.0
Zn	8.0	3.0
Fe	4.0	8.0
Cr	ND	1.0
Cd	ND	ND
Pb	ND	ND
Cu	2.0	1.0
Na / K	1.1	2.3
Ca / P	13.2	17.1

ND: not detected