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Proximate, Mineral and Amino Acid Compositions of *Irvigna gabonesis* and *Citrullus colocynthis* Used as Soup Thickener in South Easter Nigeria

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Abstract

The proximate, mineral and amino acid compositions of two seeds *Irvigna gabonesis* (ogbono) and *Citrullus colocynthis* (melon) used for soup preparation were investigated. The results revealed that the seeds were predominantly composed of carbohydrates and lipids. The carbohydrate contents were 73.58% and 70.17% respectively for *Irvigna gabonesis* and *Citrullus colocynthis.* The concentration of moisture, protein, crude fat, and ash were 3.40, 0.03, 11.00, 8.53 and 3.19% and for *Citrullus colocynthis* were 4.40, 0.77, 20.70, 1.10, and 2.86% respectively. The high carbohydrate contents confer the property of thickening soup on the seeds as well as provide a good source of energy. The concentration of calcium, phosphate and potassium were relatively higher when compared to iron, magnesium, manganese, sulphate and iodine which were generally less than1.00mg/100g of the seed samples. The concentration of arginine in *Irvigna gabonesis* and *Citrullus colocynthis* were 5.01 and 9.32g/100g protein respectively. Arginine is very essential for infants. The concentration of histidine was 2.40 and 4.77g/100g for *Irvigna gabonesis* and *Citrullus colocynthis* respectively. The seeds were also high in non-essential amino acids such as cysteine in *Irvigna gabonesis* while glutamic acid and aspartic acid were high in both seeds. The common culture of combining soups made with these seeds will effectively compensate for deficiencies in the balance of nutrients especially, the limiting essential amino acids in both seeds. The seeds can as well provide the necessary mineral elements needed for healthy growth and maintenance while the carbohydrate component can serve both energy needs and thickening functions. The seeds are both rich in oil.

Keywords: Irvigna gabonesis, Citrullus colocynthis, soup, mineral, amino acids.

Introduction

Soup is a tasty, popular food that is nutritious, wholesome, and stimulates the appetite. Thickening, usually improves the taste, but most important is the nutritional value of foods. In fact, every time the soup is thickened, its nutritive value is determined by the ingredients added to it (Fernandez-Armesto, 2002).

In the Igbo speaking part of South-East Nigeria, soup is in the centre of the people's daily food as almost all carbohydrate diet is accompanied with one form of soup or another. Thus, pounded yam, processed cassava (garri and fufu), rice, and so on are taken with soup on daily basis (Igwenyi and Akubugwo, 2010).

The three main nutrients necessary to cover the energy needs of the body are proteins, carbohydrates and lipids and are called suppliers of energy. They can replace each other calorically, but by widely varying amounts because they are subjected to the same final oxidative decomposition. However, it is possible for the body to use the protein from food (or from the body itself) as a source of energy in times of hunger when the body is compelled to do so because of inadequate supply of fat and carbohydrate from food or body sources (Heimann, 1982).

A nutrient like protein also has to fulfill a number of other functions which go far beyond energy source (Igwenyi, 2008). The primary function of dietary protein is to supply building materials for growth and maintenance of body tissues. It does this by furnishing amino acids in appropriate amounts and types for efficient synthesis of specific cellular tissue proteins. Organisms vary in their ability to synthesize the 20 common amino acids. Most bacteria and plants can synthesize all twenty, but mammals can synthesize only ten non-essential amino acids (Nelson and Cox, 2005). Thus, the essential amino acids must be obtained from food. All amino acids are synthesized from intermediates in glycolysis, the citric acid cycle, or the pentose phosphate pathway. Nitrogen is provided by glutamate and glutamine. Amino acid synthesis depends on the formation of the appropriate alpha-keto acid, which is then transaminated to form an amino acid (Guyton and Hall, 2006). Essential amino acids are those that must come from the diet. These include: arginine, isoleucine, leucine, lysine, histidine, methionine, phenylalanine, threonine, tryptophan, and valine (Igwenyi, 2008).

Minerals are essential elements that exist in inorganic form and are normally required in small amounts; hence they are called micro-nutrients (Underwood, 1997). They are needed for proper functioning of the body and have long been used in the treatment of diseases like goitre (iodine) and anemia (iron). These minerals are referred to as inorganic drugs. Minerals cannot be synthesized by the body, instead, are obtained from external sources such as food (Okaka *et al.*, 2006). Inadequate intakes of micronutrients (minerals and vitamins) have been associated with severe malnutrition, increased global burden of diseases and mental impairment (Rapil *et al.*,

1999; Black, 2003). Worldwide, over two billion people are believed to be affected by micronutrients deficiencies, to which, most are the inhabitants of low and middle income countries (Tomori and Obijole, 2000).

Some of the popular seeds used for soup preparation as condiments and thickeners in the Igbo speaking South Eastern parts of Nigeria are *Irvingia gabonesis* (ogbono) and *Citrullus colocynthis* (melon). *Irvingia gabonesis* (ogbono) is a wild seed bearing many fruit plant that grows to a height of 15-40m and has a dense, compact crown, branchlets ending in narrow, curved stipular sheath covering the leaf bud. The bark is grayish, smooth and very slightly scaly, slash yellowish-brown to light yellow, brittle, with flowers that are yellowish to greenish-white. The flowers exist in slender, clustered racemes or small panicles above the leaves or on the branchlets (Carr, 1989).

Citrullus colocynthis (melon) is creeping annual, belonging to the gourd family Ucurbtaceae (Sampson and Corner, 1980). The melon plant has smooth spherical fruits of the size the size of cucumber sometimes or as big as a small ball. The fruit is green when young and some what yellow when ripe and contains a soft spongy pulp in which are embedded numerous ovale-shaped, compressed, white or brown seeds (Ude *et al.,* 2002). These two seeds are very common and most times, used to serve a very important or dear guest in this part of Nigeria. Often, there are mixed together to enhance flavour and taste.

Materials and Methods

The samples used were fresh local indigenous seeds picked from Okposi in Ohaozara, Ebonyi State, Nigeria. They were dried in an oven at 60^{O}C for 48 hours and later milled with blender to reduce the particle size and increase the surface area.

Proximate Analyses: This is the measure of percentage proximate composition which includes the quantification of the amount of protein, lipid, carbohydrate, moisture, fiber and ash in the sample using the Official methods of analyses of AOAC (1980).

Mineral Analysis: Various photometric and titrimetric methods shall be used in the quantification of these essential nutrients. The mineral constituents were analyzed by spectrophotometric method except calcium which was determined by precipitation as oxalate by titrating with potassium permanganate solution. They were carried out using Buck Scientific Atomic Absorption/Emission Spectrophotometry (AOAC, 1980).

Determination Of Amino Acid Profile: The amino acid profile in the samples was determined using methods described by Spackman *et al*., (1985). The samples were dried to constant weight, defatted, hydrolyzed, the solvent evapourated in a rotary evapourator and loaded into the Technicon sequential Multi-sample Amino Acid Analyzer (TSM).

Result

Table 1: Proximate Analysis on *Irvigna gabonesis* and *Citrullus colocynthis* (Melon).

PARAMETER	*Irvigna gabovesis* (ogbono) %weight.	*Citrullus colocynthis* (melon) %weight.
Moisture	3.40±0.02	4.40±0.16
Protein	0.30±0.02	0.77±0.03
Crude fat	11.00±0.10	20.70±0.90
Crude fiber	8.53±0.21	1.10±0.01
Ash	3.19±0.30	2.86±0.16
Carbohydrate	73.58±0.13	70.17±0.40

Table 2: Mineral Contents of *Irvigna gabonesis* (ogbono) Seeds used as Soup Condiment In mg/100g

MINERAL (mg/100g)	*Irvigna gabonesis (*ogbono)	*Citrullus colocynthis (Melon)*
Iron	0.42±0.01	0.20±0.01
Magnesium	0.10±0.00	0.20±0.01
Potassium	32.70±0.86	5.10±0.92
Manganese	0.50±0.01	0.30±0.01
Phosphate	159.72±4.21	31.70±1.03
Sulphate	3.80±0.05	0.50±0.01
Nitrate	95.60±2.98	75.60±2.45
Iodine	5.50±0.24	0.89±0.01
Calcium	151.04±3.12	177.08±2.87

Table 3: Amino Acid Profile of *Irvigna gabonesis* (ogbono), and *Citrullus colocynthis* (melon),Using Amino Acid Analyzer, Technicon TSM-1, (Model: DNA 0209), (Concentration in g/100g protein).

Amino acid	*Irvigna gabonesis* (ogbono)	*Citrullus colocynthis* (melon)
*Arginine	5.01	9.32
*Histidine	2.02	4.79
*Isoleucine	3.42	1.68
*Leucine	6.94	1.74
*Lysine	3.67	6.35
*Methionine	0.86	5.51
*Phenylalanine	3.77	2.06
*Threonine	3.20	1.46

*Valine	3.81	2.20
Alanine	2.36	2.47
Aspartic acid	6.08	5.02
Cysteine	7.28	0.73
Glycine	4.06	2.98
Glutamic acid	9.54	5.95
Proline	3.05	1.42
Serine	2.22	2.05
Tyrosine	1.10	1.83

** = Essential amino acid.*

Discussion

The carbohydrate contents were 73.58% and 70.17% respectively for *Irvigna gabonesis* and *Citrullus colocynthis.* The concentration of moisture, protein, crude fat, and ash were 3.40, 0.03, 11.00, 8.53 and 3.19% respectively and for *Citrullus colocynthis* were 4.40, 0.77, 20.70, 1.10, and 2.86% respectively. These values showed that they were rich in carbohydrate and oil but low in protein. The moisture contents were also low but storage will entail a careful reduction in moisture to discourage microbial growth and deterioration.

The mineral analysis revealed that they were rich in mineral composition as indicated by the percentage ash composition. They were high in phosphate, potassium, calcium and nitrate contents while the concentration of iron, magnesium, manganese, sulphate and iodine were very low. Minerals are essential elements that exist in non-organic form and are normally required in small amounts; hence they like vitamins are tagged micro-nutrients (Underwood, 1997). They are needed for proper functioning of the body (Kir-Othmer, 1984). They are essential to life and an element is said to be essential when a deficiency in intake produces an impairment of function and physiological amounts of only that element can prevent or alleviate the impairment. According to Boukari *et al*., (2001), calcium intake is very low in developing countries, far below the recommended daily allowance for adults. Calcium plays a role in supportive structures of the body and its dietary deficiency together with phosphorus and vitamin D causes rickets in children, osteoporosis and osteomalacia in adults. Inorganic phosphate is necessary in the generation of the energy currency of the body (ATP) (Voet and Voet, 2004).

The amino acid composition revealed the there were rich in amino acids, especially, the essential amino acids. The concentration of arginine in *Irvigna gabonesis* and *Citrullus colocynthis* were 5.01 and 9.32g/100g protein respectively. There is no significant difference with the concentration of arginine in an egg. The concentration of histidine was 2.40 and 4.77g/100g for *Irvigna gabonesis* and *Citrullus colocynthis* respectively while a comparative analysis showed no difference from 2.4g/100g of protein in an egg (Anne, 2006). However, the values for lysine in *Irvigna gabonesis,* isoleucine, valine and phenylalanine in *Irvigna gabonesis* and *Citrullus colocynthis*, were lower than the values in an egg. The concentration of lysine, isoleucine, valine and phenylalanine are 7.20, 5.40, 6.10, 9.40g/100g of egg

protein (Anne, 2006). Egg protein is regarded as the perfect protein being the standard for evaluating proteins for much of the 20th century. Their amino acid content and digestibility are the reference against which all other protein sources are compared.

It was observed that the limiting amino acids in *Irvigna gabonesis* were lysine, methionine, isoleucine, valine and phenylalanine while the limiting amino acids in *Citrullus colocynthis* were isoleucine, leucine and valine. A combination of these two seeds will compensate for the limiting amino acids in each seed. The proximate composition showed that it can satisfy the basic nutritional requirements such as carbohydrate, fats and essential amino acids of protein, especially when combined. The mineral compositions can as well provide a balanced nutritional requirement for healthy growth and development.

References

[1] A. O. A. C. (1980). Official methods of Analysis. 13th edition Association of Official Analytical Chemists, Washington, D.C.

[2] Anne, J. (2006). "Amino acids – Benefits and its functions. *Ezine articles.com* (http://ezinearticles.com/?Amino-Acid-Benefits-and-Functions&id=338913

[3] Black, R. (2003). Micronutrient deficiency– an underlying cause of morbidity and mortality. *Bulletin of the World Health Organisation*, 8(2): 79.

[4] Boukari, I., Shier, N. W., Xinia, E., Fernandez, R., Frisch, J., Watkins, B. A., Pawloski, L. and Fly, A. D. (2001). Calcium analysis of selected western African foods. *Journal of Food Composition and Analysis* 14: 37 – 42.

[5] Carr, R. (1989). Processing of Oilseed Crops of the world, McGraw-Hill Publishing Company, New York, 226-259.

[6] Fernandez-Armesto, F. (2002). Near a Thousand Tables: *A History of Food.* New York: Free Press

[7] Heimann, W. (1982). Fundamentals of food chemistry. 2nd edition, Ellis Horwood Limited, England.

[8] Igwenyi, I. O. (2008). Biochemistry: an introductory approach. Willyrose & Appleseed Publishing Coy, Leach Road, Abakaliki, Ebonyi State, Nigeria.

[9] Igwenyi, I. O. and Akubugwo, E. I. (2010). Analysis of four seeds used as soup thickeners in the south eastern parts of Nigeria. Conference Proceedings: *International Conference on Chemistry and Chemical Engineering*, (ICCCE, 2010), August 1–3, 2010, Kyoto International Conference Center, Kyoto, Japan. 426 – 430.

[10] Kirk-Othmer, O. (1984). Encyclopedia of Chemical Technology Third Edition. NY: John Wiley and Sons, 24:104.

[11] Nelson, D. L. and Cox, M. M. (2005). Lehniger principle of Biochemistry. 5th edition. W. H. Freeman and Company. New York. 172 – 186.

[12] Okaka, J. C., Akobundu, E. N. T. and Okaka, A. N. C. (2006). Food and human nutrition an integrated approach. OCJ. Academic publishers, Enugu. Nigeria. 135 – 368.

[13] Rapil, U., Tondo, M., Nayar, D., Pathak, P., Yadar, R. and Dwivedi, S. N. (1999). Dietary intake of trace elements, minerals and vitamins among severely malnourished children and its interrelationship with nutritional status: A prospective study. *Asia Pacific Journal of Clinical Nutrition* 4(8): 268 – 271.

[14] Simpson, B. B. and Conner-Orgarzally, M. 1986). Economic botany. Plants in our world. mcGraw-Hill Inc., New York, 291-324.

[15] Spackman, D. H., Stein, E. H. and Moore, S. (1985). Automatic Recording Apparatus for use in the chromatography of amino acids. *Analytical Chemistry* **30**: 1191.

[16] Tomori, W.B. and Obijole, O.A. (2000). Mineral composition of some less utilized vegetables in Nigeria. *African Journal of Science and Technology*, 1: 153 – 157.

[17] Ude, C. M., Agu, R. C., Thomas, D. O., Molaeze, J. O., Owon, P. U. and Ude, S. C. (2002). Comparative study of the composition and food value of some edible plant seeds used as soup condiments in Nogeria. *Journal of food and technology*, 39 (3): 307-309.

[18] Underwood, E. J. (1997). Trace elements in human and animal nutrition. 4th edition. Academic press, New York, 41-42.

[19] Voet, D. and Voet, J. G. (2004). Biochemistry. 3rd Edition, John Wiley and Sons Inc., U. S. A.