CHEMICAL EVALUATION OF PROXIMATE COMPOSITION, ASCORBIC ACID AND ANTI-NUTRIENTS CONTENT OF AFRICAN STAR APPLE (CHRYSOPHYLLUM AFRCANUM) FRUIT

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ABSTRACT

The proximate composition, ascorbic acid content and anti-nutrient composition of Chrysophyllum africanum fruits was investigated. The proximate composition analysis showed the results to be, moisture 66.67%, Carbohydrate 78.34%, protein 5.66%, fibre 4.50%, fat 9.83%, ash 2.12% and total energy value 420.42 kcal The ascorbic acid content was 19.68%.The anti-nutrients composition was observed to be oxalate 4.95mg, saponins 3.66 %, Cyanogenic glycoside 0.17%, phylate 0.02% and tannins 0.03 %.The study showed that Chrysophyllum africanum fruit contain high carbohydrate and this makes it a good source of energy for human nutrition while the high moisture content gives it a very short shelf life.

Keywords: Proximate composition, ascorbic acid, anti-nutrients and Chrysophyllum africanum.

1. INTRODUCTION

Plants are primary sources of medicines, food, shelters and other items used by humans everyday. Their roots, stems, leaves, flowers, fruits and seeds provide food for humans [1 , 2].Fruits are sources of minerals, fibre and vitamins which also provide essential nutrients for the human health [3]. Some fruits are also known to have anti-nutritional factors such as Phytates and Tannins, that can diminish the nutrient bioavailability, if they are present at high concentrations [4].It has been reported that these anti-nutritional factors could also help in the treatment and prevention of several important diseases like the anti- carcinogenic activity of the phytic acid that has been demonstrated by invitro and invivo assays [3].

Chrysophyllum africanum (African star Apple) popularly known as Agbalumo among the Yorubas, Agwaluma among the Hausas and Udari among the Efiks and Ibibios in southern Nigeria is a fruit that is commonly eaten raw in the study area.

It is a large berry that contains up to five seeds that are flat in shape. The plant belong to the family sapotaceae. The leaves of the plant are alternate and nearly evergreen elliptic, slightly leathery.the fruit could be ellipsoid, round or pear shaped. It has a milky sweet pulp that houses the seeds. When the fruit is cut transversely it appears like an asterisks in the central core or like the pointed stars. This is the origin of the name of the fruit as "STAR APPLE" The fleshly fruit is eaten raw by most people and relished by many others [5].Apart from the work carried out by [6] on the proximate composition, ascorbic acid and mineral content of this fruit obtained from Ibadan in southwest of Nigeria, there is no other information on the proximate composition, Ascorbic acid content and anti-nutrients composition of Chrysophyllum africanum fruit cultivated in the study area. This study is therefore aimed at finding out the proximate composition, ascorbic acid content and anti-nutrients composition of chrysophyllum africanum fruit cultivated in the study area for the public awareness of its nutritional and anti-nutritional status.

2. MATERIALS AND METHODS

2.1 Sample Collection and Preparation

The fruits of Chrysophyllum africanum used in this study were obtained from a plantation in Calabar, the capital of Cross River State of Nigeria, in March 2010. The fruits were identified by a taxonomist Mr frank of the Department of Botany, University of Calabar , Calabar. The fruit samples were taken to the laboratory after identification. They were washed and their skin peeled, the pulp (edible portion) chopped into pieces. They fruits were divided into two portions .One portion was used for the determination of the moisture and ascorbic acid contents. The other portion was dried in hot air circulating oven (Gallenkamp DV330) at 65^0C to a constant weight for (18-24h).The dried samples were ground into powder using an electric blender with steel blades and stored in screw capped containers at 4-6^o C. Proximate composition analysis of the samples for ash , crude protein, crude fat, crude fibre and total carbohydrate were carried out in triplicates according to the standard methods of analysis, as described by the Association of Official Analytical Chemists(AOAC,1990).using dry samples. The energy value was calculated using the Atwater factors of 4, 9, and 4 for protein, fat and carbohydrate, respectively.[8][9] The Ascorbic acid content

was determined according to the standard methods [7].The quantitative determination of Oxalates, Phytates, Tannins, Saponins ,and Cyanogenic glycosides were carried out according to standard methods [7]

3. RESULTS AND DISCUSSION

The results of proximate composition, Ascorbic acid content and energy value of Chrysophyllum africanum (African Star Apple) fruits is represented in table (1). Moisture content of the fruits of C.africanum from the analysis was (66.67 %) which is higher than (42.10%) earlier reported for the same fruits [6]. This value is lower than (85.1%) moisture content reported for Averrhoa carambola [10],(94.8%) reported for Solanum gilo and (94.6) for Solanum aubergine fruits [11].The moisture content of any food is an index of its water activity [12] and is used as a measure of the stability and susceptibility to microbial contamination [13]. This implies that C africanum fruits may have a short shelf-life due to its high moisture content. The high moisture content also implies that dehydration would increase the relative concentrations of the other food nutrients and improve the shelf-life of C.africanum fruits [11,14]. The crude Fat (9.38%) observed for the fruit in this study is lower than (16.20%) earlier reported for the same fruit [6],it is also lower than (11.7%) crude fat content reported for Averrhoa carambola fruits [10] but higher than (7.0%) and (4.00%) reported for S. agilo and S aubergine fruits respectively [11]This indicates that C africanum fruits contains a moderately high level of crude fat. The ash content of the C africanum fruits obtained in this study was (2.12%)This value is close to (2.95%) earlier reported for the same fruit [6].This value is lower than the (3.50%) reported for A. carambola fruit [10] and (10.0%) reported for both S.gilo and S.aubergine fruits [11]. The protein content of C.africanum fruit obtained from the analysis was (5.66%) which is lower than (8.75%) earlier reported for the same fruit [6].The value is also lower than (14.87%) and (15.75 %) reported for S.gilo and S. aubergine respectively [11] but higher than (4.0%) reported for A. carambola fruits [10]. This result shows that C.africanum fruit is very low in its protein content. This value can be improved by the dehydration of the fruits [14] The crude fibre content of C africanum fruit (4.50%) obtained from the analysis is same as that earlier reported for the same fruit [6].This value is lower than (8.60%) reported for A.carambola fruits [10] The value is also lower than (16.0%) and (11.75%) reported for S.gilo and S.aubergine fruits respectively [11].The crude fibre content of C afrcanum fruits can be increased by the dehydration of the fruits, as the consumption of fruits with high crude fibre content may contribute to a reduction in the incidence of certain diseases like colon cancer , coronary heart diseases diabetes , high blood pressure, obesity and other digestive disorders [14,16,17,18 and 19].Increased crude fibre consumption also increase fecal bulk and rate of intestinal transit and have prebiotic effects [14].The carbohydrate content (78.34%) obtained for C africanum fruit is higher than (67.60%) earlier reported for the same fruit [6].This value is also higher than (72.20%) reported for A.carambola fruits [10], (52.13%) and (58.5%) reported for S.gilo and S.aubergine fruits respectively [11]

The total metabolisable energy for C.africanum fruit was observed to be 420.42kcal. This was in close range with 448.83 kcal reported for Gnetum africanum seeds [20],403.54 kcal reported for Solanum nigrum seeds [11] and 384.33 kcal reported for B. coricea seeds [1] .This result shows that C africanum fruit is a good source of energy than can be utilized as human nutrition.

The ascorbic acid content of C africanum fruit is (19.68%) which is higher than (4.60%) reported for A. carambola fruit [10], but lower than (53.5%) reported for Tetracarpidum conophorum seeds [22] (93.7%) and (75.9%) reported for S.gilo and S.aubergine fruits respectively [11].The high level of ascorbic acid in this fruit shows that the fruit could be used to promote healthy living such as protection against scurvy and other ascorbic acid deficiency related ailments.

The results for the Anti-Nutient composition of C.africanum fruit is represented in (table 2).The results show that C.africanum fruit has a high level of oxalates (4.99mg/100g) and saponins(3.66mg/100g), a moderate level of cyanogenic glycoside (0.730mg/100g) with a low levels of phytate (0.032 mg/100g) and tannins (0.029 mg/100g). The oxalate value is higher than (1.06mg/100g) reported for B.coricea seeds [1] and (0.159mg/100g) reported for Pennsetum purpureum [15] but, lower than (58.81mg/100g) reported for seeds of Solanum nigrum [21] and (109.00mg/100g) reported for Gnetum africanum seeds [20].The saponin content was quite high compared to (.0.66mg/100g) reported for S. nigrum seeds[21],(0.80mg/100g) reported for C.odorte leaves[14] and (0.850mg/100g) reported for Pennsetum purpureum [15] but, lower than 4.03mg/100g) reported for B.coricea seeds [1] and (10.30mg/100g) reported for Tridax procumbens [23].The saponins are known to reduce the uptake of certain nutrients like glucose and cholesterols at the gut through intra-lumenal physicochemical interaction [24].Also when saponins are consumed they may aid in lessening the metabolic burden that would have been placed on the liver [14].The saponins are also known to inhibit structure dependent biological activities [25].

The Cyanogenic glycoside level in C africanum fruit is lower than (2.83% reported for Pennsetum purpureum [15].The tannin content of this fruit is lower than (0.11mg/100g)reported for B.coricea seeds [1], (0.47mg/100g) reported for Tridax procumbens [23] and (28.64%) reported for Pennsetum purpureum [15] .The phytate content of C. africanum fruit is higher than (0.006%) reported for Pennsetum purpureum [15] ,but lower than (3.18mg/100g reported for B. coyicea seeds [1]. The knowledge of phytate levels in food is necessary because, high concentration of phytate can cause adverse effect on digestibility Also,phytic acid binds metal ions like calcium, zinc, iron and other minerals, thereby reducing their availability in the body.[17]. They also inhibit digestion of proteins by forming complexes with them [26].The high levels of some of the Anti-Nutrients in C.africanum fruit can be reduced by a number of processing methods like, soaking, boiling and fermentation etc [17,27,28,]

Conclusion; This study showed that Chrysophyllum africanum fruits contain high percentage of carbohydrate (78.34 %) which makes it a good source of human energy. It also contain moderately high amount of ascorbic acid (19.68%) which is good for the body as it can be used for protection against scurvy and other ascorbic acid deficiency related ailments. This work has shown that this fruit has a good medicinal value for the management of certain health conditions like hypercholesterolemia.

Table 1; Proximate composition, Ascorbic acid content and Energy value of Chrysophyllum africanum fruit.

Parameters	Composition
Moisture (%)	66.67± 0.02
Crude fat (%)	9.38 ± 0.01
Ash (%)	2.67± 0.02
Crude Protein (%)	5.66 ± 0.01
Crude Fibre (%)	4.45 ± 0.02
Carbohydrate (%)	78.34 ± 0.03
Ascorbic acid (mg/100ml)	19.68 ± 0.02
Energy Value (kcal)	420.42

Table 2; Anti-Nutrient Composition of Chrysophyllum africanum fruits.

Parameters	Composition (mg/100g)
Saponins	3.663 ± 0.02
Oxalates	4.995 ±0.01
Tannins	0.29 0± 0.02
Phytates	0.320 ± 0.02
Cyanogenic Glycoside	0.173 ± 0.01

• Values are means of triplicate determinations and standard Deviation.

REFERENCES

[1]. Amaechi, N.C (2009): Nutritive and Anti – Nutritive Evaluation of wonderful Kola (Buccholzia coricea) seeds. Pakistan journal of Nutrition 8 (8) 1120- 1122.
[2]. Hemingsway, C. A.(2004) : Plants and People Edible Plant J.P.1
[3]. Ali Beroumand and S.S .Deokule (2009). Studies on Nutritional values of some wild Edible plants from Iran India. Pak..J. Nutri 8 (1):26-31
[4]. Ojako, O. A. and C,U.Igwe, (2008): the nutritive, anti- nutritive and hepatotoxic properties of trichosanthes anguina (snake tomato) fruits from Nigeria pak. J. nutrition, 7: 85-89
[5]. CENDARD 1999 Publication of center for environmental renewable natural resources management, Research and development, Jerico, ibadan publication No CEN 011/1999 85.
[6]. Amusa, N. A, O. E Ashaye, and M, O. Oladapon(2003): Biodeterioration of proximate composition of African star apple in storage and effect on its food value, African journal of biotechnology 2(3) 56-59.
[7]. AOAC 1990: Official methods of analysis. Association of Analytical chemists, Washington D.C Ed.
[8]. FAO/WHO/UNU 1991 Energy and protein requirements report of a joint FAO/WHO/UNU Expert consultation WHO Technical report series 724.Http:// wwo.org/doc rep/003/9904 oc/AA040 EOI.htm.
[9]. Chancy, S.G. (2006): Principle of Nutrition 1: macronutrients, in : Delvin,T. M (Ed), Textbook of biochemistry, clinical correlation, 6th edn. John wiley and sons New York pp 1071-1090 ISBN 100-471-67808-2.

[10]. Edem,C.A.,M.I.Dosunmu, A.C.Ebong and M.Jones (2008): Determination of Proximate composition of Ascorbic acid and heavy metal content s of star fruit (Averrhoa Carambola) global journal of p and App. Sciences 14 (2) 193-195
[11]. Edem C.A. Dosunmu M.I, Bassey F.I. Wilson, C and Umoren,P. (2009b) A Comparative Assessment of the proximate composition, Ascorbic Acid and heavy metal content of of two species of Garden Egg solarium gilo and and solarium anbergrine Pakistan journal of nutrition 8(8) 582-584.
[12]. Frazier, W.S. and D.C.Wwstoff (1978): Food microbiology 3rd edition, McGraw Hill, New York.
[13]. Scott, W.S. (1980) water relations of food spoilage microorganisms. Adv. Food res 7: 84-0127.
[14]. Igboh,M.Ngozi, Ikewuchi,C.Jude and Ikewuchi,C.Catherine (2009) Chemical profile of chormolaena odoratal pak. . nutria. 8(5):521-524.
[15]. Okaraonye,C.C and J.C. Ikewuchi (2009). Nutrition and anti-nutritional components of pennisetum pinpureum schmach, Pak .J.Nutr.8:32-34.
[16]. Walker, A.R.P.1978, the relationship between bowel cancer and fibre content in the diet. AM. J.clin Nutr 31 5248-5251
[17]. FAO, 1990. Root, Tuber, plantains and bananas in human nutrition. FAO Corporate document Repostory, Rome http//www.fao.org/docrep/t0207e/T0207EO8.htm#7.
[18]. Eriyamremu,G.E.and I. Adamson(1994)Early change in Energy metabolism in rats Exposed to an Acute level of Deoxycholate and Fed. a Nigeria-like Diet Ann Nutr. Metab.,38:174-183
[19]. SACH, 2008.Draft SACN position on dietary fibre and health and the dietary fibre definition SACN /08/20. http://www.sacn.gov.uk/pdfs/final_draft_sacn statement.
[20]. Ekpo, A.S.(2007). Determination of chemical composition of Gnetun africanum (Afang) seeds. Pak.J. Nut 6: 40-43
[21]. Akubugwo, I.E; A.N.Obasi and S.Ginika(2007) Nutritional Potential of leaves and seeds of Black Nightshade solarnum nigrum L Var Virginicum from Afikpo-Nigeria. Pak. J. Nutri 6:323-326.
[22]. Edem,C.A; Dosunm,M.I.and Bassey F.I. (2009a). Determination of proximate composition,Ascorbic acid and heavy metal content of African walnut (Tetracarpidium conophorum) Pakistan journal Nutrition 8(3) 225-226.
[23]. Ikewuchi,C.Jude,Ikewuchi C.Catherine and M.Igboh Ngozi (2009): chemical profile of Tridax procumbens linn. Pak. J. NUTRI:8(5) 548-550.
[24]. Price,K.R;L.I.Johnson and H.Feriwich(1987). The chimcal and biological significance of saponims in food and feeding stuffs, crit. Rev. food sci.nutria 26: 127-135.
[25]. Savage,G.P.(1993) Saponins. In: Encylopedia of Food science Food Technology and Nutrition. R.Macrae,R.K.Robinson and M.J.Sadler (eds) Academic Press 24/28 Oval Road, London NW 17 DX PP: 3998-4001.
[26]. Singh,M. and A.D.Krikoran,(1982). Inhibition of trypsin activity in vito by phylate. Journal of Agric. Food chem., 30: 799-800.
[27]. Esenwah,C.N.and M.J.Ikenebomeh (2008)Processing Effects on the Nutritional and Anti-Nutritional contents of African Locust Beans (Parkia biolobsa Benth) seed Pak. J. Nutri. 7: 214-217.
[28]. EL-Adway,T.A.(2002) Nutritional composition and anti-nutritional factors of chick peas (acer arietinum l) undergoing different cooking methods and germination plant foods Itum. Nutr. 57: 83-97.