African Journal of Agricultural Research Vol. 5(11), pp. 1273-1276, 4 June, 2010
Available online at http://www.academicjournals.org/AJAR
DOI: 10.5897/AJAR10.319
ISSN 1991-637X ©2010 Academic Journals

Full Length Research Paper

Nutritional composition of breadnut seeds (*Artocarpus camansi*)

R. O. Adeleke and O. A. Abiodun*

Department of Food Science and Technology, Osun State Polytechnic, Iree, PMB 301, Osun State, Nigeria.

Accepted 20 May, 2010

This work was carried out to determine the nutritional composition of breadnut (*Artocarpus camansi*) seeds. Matured breadnut seeds were obtained opened and the seeds were removed for analysis. They were analyzed for proximate mineral, amino acids, fatty acids and organic acids composition. The results showed the values of the proximate composition of the breadnut seeds as: protein (4.87%), fat (3.48%) and carbohydrate (26.11%). Ash and crude fiber were 3.43 and 1.20% respectively. The highest mineral content value was in phosphorus 363 mg/kg followed by potassium 325 mg/kg and sodium 248 mg/kg while the lowest value was in iron 0.05 mg/kg and copper 0.12 mg/kg. The predominant essential amino acids determined in the seeds were leucine 392 mg/kg, phenylalamine 312 mg/kg, arginine 293 mg/kg, isoleucine 245 mg/kg and lysine 275 mg/kg. The oil was rich in palmitic 21.4%, oleic 12.4 % and linolenic acid 14.8%. Lactic and citric acids were the predominant organic acid while malic, acetic and butyric acids were present in trace amount. The breadnut seeds could be used as composite flour and the oil could be a good source of edible oil for human consumption.

Key words: Breadnut, nutritional composition, proximate, mineral, amino acid, fatty acids.

INTRODUCTION

Breadfruit (*Artocarpus altilis)* belongs to the Mulberry family Moraceae. In Nigeria, the breadfruit is regarded as the poor man's substitute for yam (*Dioscorea esculenta* and *D. cayenensis*), because it is used in several traditional food preparations of yam, but costs less than one-third the cost of procuring yam at the market. It is used in soft and stiff porridge dishes, boiled as boiled yam, fried as chips and roasted as roast yam (Mayaki et al*.,* 2003). The breadfruit had been made into flour and evaluated in bakery products (Olatunji and Akindele, 1978). Breadnut, *Artocarpus camansi*, has often been considered to be a seeded breadfruit. The trees provide shade, mulch, soil stabilization, animal fodder and are commonly used in mixed agroforestry systems and home gardens. This species is primarily grown for its nutritious seeds, and there is much variation in seed number, size, and nutriational composition. It is a good source of protein and low in fat compared to nuts such as almond, and Brazil nut. The nutritious fruits are usually consumed when immature, thinly sliced and boiled as a vegetable in soups or stews (Ragone, 2006). Despite the nutritive value of these seeds, it had been reported to be an under-utilized food source (Roberts-Nkrumah, 2005). Although, various research works had been carried out on the composition and usefulness of breadfruit as food (Graham and DeBravo, 1981; Adewusi, 1995; Mayaki et al., 2003; Adebowale et al., 2008) but there are limited works on the chemical, amino acids, fatty acids, organic acid composition and uses of breadnut seeds as food. Therefore, this work evaluates the nutritional composition of breadnut seeds.

MATERIALS AND METHODS

Raw material

Matured breadnut fruits (*Artocarpus camansi*) were obtained on the farm at Iree, Osun State, Nigeria. The fruits were opened and the seeds were removed and analyzed.

Analyses

Breadnut seeds samples were analyzed for moisture, ash, crude protein, crude fiber and fat content using the methods described by

*Corresponding author. E-mail: funmiabiodun2003@yahoo.com

AOAC (1990). The mineral contents of phosphorus, potassium, sodium, calcium, iron, manganese, copper and magnesium were determined using the method of Ilelaboye and Pikuda (2009). Ten amino acids (arginine, histidine, isolueucine, leucine, lysine, phenylalamime, tyrosine, cystine, tryptophan and methionine) were estimated using the method of Ketiku (1973). The fatty acid composition was determined by the method described by Ebuehi and Avwobobe (2006) using Hewlett Packard series injector type Gas chromatography. Organic acids were evaluated using the methods of Usenik et al. (2008). The results were in triplicate and standard deviation was calculated for each parameter.

RESULTS AND DISCUSSIONS

Proximate composition

The proximate composition of breadnut seeds are shown in Table 1. Moisture content of breadnut was 60.96%. This value was higher than the values (35.08 -56.80%) obtained by Morton (1987) and within the values (56.0 - 66.2%) obtained by Ragone (2006). The high moisture content indicates its high perishablility. Protein content value of breadnut seeds was 4.87%. This value was lower than the value (5.25 - 13.3g) on wet basis reported by Morton (1987).

This may be due to the species used, location and cultural practices adopted during planting. Also, Ragone (2006) reported protein content of 13.3 -19.6% on dry basis. Protein content of 15.76% (dry basis) was recorded by Nwabueze (2006) for raw flour of African breadfruit (*Treculia africana*) seeds. These showed that the seeds have appreciable amount of protein which are good for growth and repair of worn out tissue. Values of 1.20 and 3.43% were estimated for crude fiber and ash content respectively.

Fat content of 3.48% was obtained for breadnut seeds which was within the range of values (2.59 - 5.59%) reported by Morton, (1987). Fat content of 6.2 -29.0 and 11.45% were recorded for breadnut seeds on dry basis (Ragone, 2006) and African breadfruit seeds (Nwabueze, 2006), respectively. The value obtained for carbohydrate was 26.11%.

This was lower than the range estimated by Morton (1987). The carbohydrate content was higher than Nigerian pear (*Dacryodes edulis*) 13.1% (Hart et al., 2006) and full fat fluted pumpkin seed flour (Fagbemi, 2007). The seed serves as good source of energy. Ragone (2006) observed variation in the breadnut seed size, number and nutritional composition.

Mineral composition

The mineral composition of breadnut seeds are shown in Table 2. The highest mineral content was in phosphorus (P) with value 363 mg/kg followed by potassium (K) with value of 325 mg/kg. The P value was comparable to the values (322.20-411.60mg/kg) obtained by Ilelaboye and Pikuda (2009) for three lesser known seeds determined. Also present were sodium (Na) 248mg/kg, calcium (Ca) 185 mg/kg, iron (Fe) 0.05 mg/kg, manganese (Mn) 1.20 mg/kg copper (Cu) 0.12 mg/kg and magnesium (Mg) 1.48 mg/kg. The values of K, Na, Mg, Fe and P reported by Fagbemi (2007) for dried fluted pumpkin seed flour were 11,388, 303.04, 1,898, 59.06 and 10,577 mg/kg, respectively. These values were higher than the values estimated for breadnut seeds. The Ca content of breadnut seeds was higher than that of fluted pumpkin seed flour (77.99 mg/kg) as reported by Fagbemi (2007). Mineral content depends on the species, soil type, climatic condition, season, water source and cultural practices adopted during planting (Steven et al., 1985).

Amino acid

The amino acids determined are shown in Table 3. Ten amino acids were quantified of which six were essential amino acids and four non- essential amino acid. The seed was rich in leucine 392 mg/gN and phenylalamine 312 mg/gN. The seed was low in tryptophan 24 mg/gN and methionine 95 mg/gN but could be supplemented with other flour. Morton (1987) recorded higher value for methionine 3.17 mg/100 gN, leucine 2.60 mg/100 gN and isoleucine 2.41 g/100 gN in breadnut seed. Variation in the values of amino acid also depends on the species of the fruits.

Fatty acid composition

The fatty acid compositions of breadnut seeds oil are given in Table 4, which showed the principal fatty acid components in the breadnut seeds oil to be palmitic 21.4%, linolenic 14.8% and oleic 12.4%. The seeds contain both saturated and unsaturated fatty acids and some unidentified fatty acid. The saturated fatty acids identified included palmitic, lauric, and stearic acid with values 21.4, 1.7 and 2.0% respectively. The oil was rich in unsaturated fatty acid such as oleic, linolenic and arachidonic acid. The values for oleic acid and palmitic acid were comparable with those of melon seeds oil (Mabalaha et al., 2007) while the value for linolenic acid was greater than that of sunflower, soybeans and groundnut oil (Kirk and Sawyer, 1991). These findings suggest that breadnut seeds oil is a good source of essential fatty acids and edible vegetable oil for human consumption. The oil had been reported to be viscous at room temperature with a characteristic odour similar to peanut and chemical/ physical characteristics similar to olive oil (Ragone, 2006).

Organic acid

The content of organic acids in breadnut seeds are shown in Table 5. The predominant acid in breadnut

Table 1. Chemical composition of breadnut seeds.

Chemical composition	Breadnut seeds (%, wet basis)
Protein	4.87 ± 0.50
Fat	3.48 ± 0.13
Crude Fibre	1.20 ± 0.26
Ash	3.43 ± 0.52
Moisture	60.96 ± 0.41
Carbohydrate	26.11 ± 0.14
Dry matter	39.04 ± 0.33

Mean values ± standard deviation (n=3)

Table 2. Mineral content of breadnut seeds.

Mineral content	Breadnut seeds (mg/100 g, wet basis)
K	325 ± 0.14
Ca	185 ± 0.39
P	363 ± 0.67
Fe	0.05 ± 0.21
Cu	0.12 ± 0.33
Mn	1.20 ± 0.49
Na	248 ± 0.50
Mg	1.48 ± 0.38

Mean values ± standard deviation (n=3)

Table 3. Amino acid composition of breadnut seeds.

Amino acid composition	Breadnut seeds (mg/g N)
Arginine	293
Histidine	167
Isoleucine	245
Leucine	392
Lysine	275
Phenylalamine	312
Tyrosine	185
Cystine	112
Tryptophan	24
Methionine	95

seeds are lactic acid (0.317 mg/kg) and citric acid (0.185 mg/kg). The seeds exhibited trace amounts of acetic acid (0.050 mg/kg), butyric acid (0.012 mg/kg) and malic acid (0.012 mg/kg). The organic acids evaluated (malic and citric acid) were lower than the values obtained for Syrian sumac and Chinese sumac fruits (1568.04 mg/kg for malic and 56.93 mg/kg citric acid) by Kossah et al. (2009). The results indicate that breadnut seeds are low in organic acid content and the fresh breadnut seeds are susceptible to spoilage.

Table 4. Fatty acid composition of Breadfruit seeds.

Fatty acid composition	Breadnut seeds (%)
Oleic ($C_{18:1}$)	12.4
Stearic ($C_{18:0}$)	2.0
Lauric ($C_{12:0}$)	1.7
Palmitic ($C_{16:0}$)	21.4
Linolenic($C_{18:3}$)	14.8
Arachidonic ($C_{20:4}$)	1.9

Table 5. Organic acids composition of Breadnut seeds.

Organic acid	Breadnut seeds (mg/kg)
Butyric acid	0.012 ± 0.12
Citric acid	0.185 ± 0.32
Acetic acid	0.050 ± 0.48
Malic acid	0.012 ± 0.17
Lactic acid	0.317 ± 0.51

Mean values ± standard deviation (n=2)

Conclusion

This study has shown that breadnut seeds (*Artocarpus camansi*), contain appreciable amount of protein, carbohydrate and mineral contents. The oil was rich in unsaturated fatty acid which compared well with those of melon seeds, soybean and groundnut oil. The oil serves as a good source of edible fat for human consumption and could be refined to eliminate the odour. The flour from the seeds could also be used as composite flour for baking. The seeds have low organic acid which denote the keeping quality of the seeds. The seeds need to be processed to avoid spoilage and wastage during its season.

REFERENCES

Adebowale AA, Sanni SA, Oladapo FO (2008). Chemical, functional and sensory properties of instant yam –breadfruit flour. Niger. Food J., 26(1): 1-12.

Adewusi SRA, Udio AJ, Osuntogun BA (1995). Studies on the carbohydrate content of breadfruit (*Artocarpus communis* Frost) from South Western Nigeria. Starch/Starke, 47: 287-294.

AOAC (1990). Official methods of analysis. 15th edition. Association of Official Analytical Chemist, Washinton D.C.

Ebuehi OA, Avwobobe OK (2006). Physico-chemical and fatty acid composition of water melon (*Citrillus lanatus*) and melon (*Colocynthis citrillus*) seed oils. Niger. Food J., 42(1): 25-33.

Fagbemi TN (2007). Effects of processing on the nutritional composition of fluted pumpkin (*Telfairia occidentalis*) seed flour. Niger. Food J., 25(1): 1-22.

Graham HD, DeBravo EN (1981). Composition of the breadfruit. J. Food Sci., 46: 535-539

Hart AD, Barimalaa IS and Kiin-Kabari DB (2006). Utilisation of the Nigeria Pear (*Dacryodes edulis*) as a spread. Niger. Food J., 24(1): 114-122.

Ilelaboye NO, Pikuda OO (2009). Determination of minerals and anti-

nutritional factors of some lesser-known crop seeds. Park. J. Nutr., 8(10): 1652-1656.
Ketiku AO (1973). Chemical composition of unripe and ripe plantain (*Musa parasidica*). J. Sci. Food Agric., 24: 703-709.
Kirk SR, Sawyer R (1991). Pearson's composition and analysis of foods, 9th edn. Longman, UK, pp. 617-620.
Kossah R, Nsabimana C, Zhao J, Chen H, Tian F, Zhang H, Chen W (2009). Comparative study on the chemical composition of Syrian sumac (*Rhus coriaria* L.) and Chinese Sumac (*Rhus typhina* L.) Fruits. Pak. J. Nutr., 8(10): 1570-1574.
Mabalaha MB, Mitei YC, Yoboah SO (2007). A comparative study of the properties of selected melon seeds oils as potential candidates for development into commercial edible vegetable oil. J. Am. Oil Chem. Soc., 84: 31-34.
Mayaki OM, Akingbala OJ, Baccus-Taylor GSH, Thomas S (2003). Evaluation of breadfruit (*Artocarpus communis*) in traditional stiff porridge foods. Food Agric. Environ., 1(2): 54-59. 2003
Morton J (1987). Breadfruit. In: Julia F. Mortom and Miami F.C. (eds). Fruits of warm climates, pp. 50-58.
Nwabueze TU (2006). Effect of hydration and screw speed on the nutrient and acceptability of extruded ready-to-eat African breadfruit (*Treculia africana*) snack. Niger. Food J., 24(1): 107-113.
Olatunji O, Akinrele AI (1978). Comparative rheological properties and bread qualities of wheat flour diluted with tropical tuber and breadfruit flours. Cereal Chem., 55: 1-6
Ragone D (2006). *Artocarpus camansi* (Breadnut), ver.2.1. In: Elevitch, C.R.(ed). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR). Holualoa, Haiwai'i. pp. 1-11
Roberts-Nkrumah LB (2005). Fruit and seed yields in chataigne (*Artocarpus camansi* Blanco) in Trinidad and Tobago. Fruits, 60(6): 387-393
Steven RT, Vernon RY, Michael CA (1985). Vitamins and Minerals. In: Fennema, O. (ed). Food Chemistry. (2nd ed), Marcel Dekker, New York. p. 523
Usenik V, Fabele J, Stampar F (2008). Sugars, organic acids, phenolic composition and antioxidant activity of sweet cherry (*Prunus avium*. L). Food Chem., 107: 185-192.