IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT)
e-ISSN: 2319-2402,p- ISSN: 2319-2399.Volume 9, Issue 1 Ver. III (Jan. 2015), PP 01-04
www.iosrjournals.org

Comparative Evaluation of Proximate Composition and Functional Properties of Two Varieties of Cooking Banana

Onwuka, G. I.[1], Onyemachi, A. D.[1], David-Chukwu, N. P.[2]
[1]*Department of Food Science and Technology, Michael Okpara University of Agriculture, Nigeria.*
[2]*Department of Hospitality Management Technology, Abia State Polytechnic, Nigeria.*

Abstract: *The two varieties of cooking banana (Musa cardaba and Musa bluggoe) were evaluated for proximate composition and functional properties. The results of the proximate composition showed that the mean protein values ranged from 4.49 to 4.79%, fat content ranged from 0.78 to 0.84%, carbohydrate content ranged from 78.85 to 79.88%, moisture content ranged from 10.00 to 10.34%, crude fibre ranged from 0.71 to 0.85% and ash content ranged from 3.83 to 4.62%. In the functional properties, the result showed that bulk density ranged from 0.74% to 0.79%, water absorption capacity ranged from 1.89 to 1.93%, oil absorption capacity ranged from 2.30 to 2.78%, while wettability ranged from 59.66 to 60.66 secs.*
Keywords: *Absorption capacity, bulk density, cooking banana flour, functional properties, proximate composition.*

I. Introduction

Banana is the common name of herbaceous plants of the genus *Musa* and for the fruit they produce. Banana plants are monocotyledons, perennial and important crops in the tropical and subtropical world region [1].They include desert banana, plantain and cooking banana. Cooking banana is a major staple food; it is starchy, rich in carbohydrate, calcium, phosphorous, iron and other food nutrients [2].

Cooking banana is shorter, fatter and heavier than plantain and because of this, it is common in the market and less attractive to consumers, hence attracts low prize in the market [3]. Most producers of cooking banana are small scale farmers either for home consumption or local market. Cooking banana produce fruit all year-round, they provide an extremely valuable food source during the hunger season (when the food from one annual/semi-annual harvest has been consumed and the next is still to come). Cooking banana is therefore critical to global food security. The shelf life of cooking banana is relatively short and at ripe stage becomes too soft and difficult to pound, slice or fry. In other to avert these problems encountered during processing; it may be necessary to convert fresh bunches of cooking banana into flour to increase its utilization and improve its market potential which will be of good advantage to food processors [3].

Cooking banana flour is potential flour, which could be used or blended with wheat flour for baking, confectioneries and extruded foods. Wheat flour is a product of a temperate crop that is unique among the cereal grain flour in that when mixed with water its protein component forms an elastic network capable of holding gas and developing a firm spongy structure during baking. The percentage of wheat flour required to achieve a certain effect in composite flour depends heavily on the quality and quantity of wheat gluten and the product involved. The objective of this work was to investigate the proximate composition and functional properties of cooking banana flour.

II. Materials And Methods

Fully matured cooking bananas were harvested from the Michael Okpara University of Agriculture, Umudike farm.

2.1. Processing Methods

The fruits were sorted manually and bruised fingers removed from the bunch. The fruits were washed, peeled and sliced with the aid of a plantain cutter to obtain uniform thickness of about 5mm for rapid drying. The sliced cooking bananas were dried in the oven for 2 hours at 60^{o}C. The dried slices were milled using a hammer mill and the resulting flour was sieved using 425-300 micrometer mesh size sieve. The flour was packaged in moisture proof polyethylene bags and labeled. The method used for processing of the cooking banana flour was the method used by [4] as represented in Fig 1:

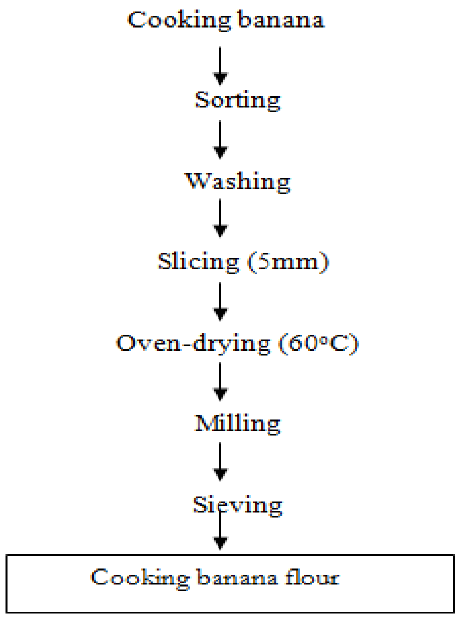

Fig 1: Flow chart for the production of cooking banana flour.

2.2. Analyses

2.2.1 Proximate Analysis

The flour sample was analyzed for proximate composition according to [5], [6] and was determined in triplicates. Moisture content was determined by weighing 5g of the sample and drying in an oven at 105^0C to constant weight. Ash content was determined by incineration of 5g of the sample in a muffle furnace at 525^0C and the weight of the ash was calculated by difference. Crude protein was determined by kjeldahl method. The crude fibre was determined by the Wende methods [6] . Crude fat was quantified by Soxhlet extraction method. Carbohydrate was estimated by difference [5].

2.2.2 Functional Analysis

The bulk density (BD), emulsion capacity, swelling index, water/oil absorption capacity, wettability, foam stability, foam capacity were determined as described by [7]. A modified method of [8] was used to determine gelation capacity.

2.2.3 Statistical Analysis

Replicate readings of measurements were subjected to Analysis of variance (ANOVA), While the means were separated using Duncan's multiple Range Test [9].

III. Results And Discussion

3.1 Proximate Analysis

The Proximate composition of flour samples of the two varieties are presented in Table 1. No significant differences ($p > 0.05$) in the proximate composition of the flour were observed, though unripe *cardaba* flour had the highest moisture content (10.34%) and unripe *bluggoe* had the least moisture content (10.00%). Product moisture is significant to shelf-life, packaging and general acceptability [10],[11]. The reduction of moisture content of any food during flour production helps to enhance the stability and adaptability for further use in food production.

The ash content of unripe *bluggoe* (3.83%) was lower when compared with the unripe *cardaba* (4.62%). Ash is considered among the chemical characteristics that define quality of wheat flour [12] , [13]. The values of the ash content shows that there is a significant difference ($p < 0.05$) the flour samples. Unripe *bluggoe* had a significantly lower ($p<0.05$) fat content (0.78%) compared with unripe *cardaba* (0.84%).

The carbohydrate content of the flour samples was highest in unripe *bluggoe* (78.88%) and lower in unripe *cardaba* (78.85%). There was no significant difference ($p>0.05$). The two flour samples are considered as starchy staple foods and rich sources of carbohydrate because of their high carbohydrate content [14] .

The crude protein content of unripe *bluggoe* (4.79%) was higher than that of unripe *cardaba* (4.49%), there was no significant difference ($p>0.05$) Banana and Plantain generally contain *bluggoe* low protein [4]. The crude fibre content of unripe *cardaba* (0.85%) was higher than that of the unripe (0.71%). The values obtained for the two flour samples were significantly different ($p<0.05$).

Table 1: Mean proximate composition of cooking banana flour samples

Sample	Moisture	Ash	Fat	Crude Protein	Crude Fibre	carbohydrate
URC	10.34[a] ± 0.01	4.62[a] ± 0.01	0.84[a] ±0.05	4.49[a]± 0.16	0.85[a]±0.02	78.85[a]±0.28
URB	10.00[a]± 0.24	3.83[b] ± 0.15	0.78[b] ± 0.03	4.79[a]± 0.03	0.71[b]± 0.05	79.88[a] ± 0.38

Means with the same superscript are not significantly different ($p>0.05$)

KEY:

URC Unripe *cardaba*
URB Unripe *bluggoe*

3.2 Functional properties:

The functional properties of flour from the two varieties of cooking Banana were shown in Table 2. It showed that bulk density (BD) of unripe *cardaba* was higher 0.79g/ml and unripe *bluggoe* was 0.74%. The bulk density is generally affected by the particle size and the density of the flour. It is very important in determining the packaging requirement, material handling and application in wet processing in food industry [15]. The result also showed that the water absorption (WAC) of unripe *bluggoe* (1.93%) was higher than that of unripe *cardaba* (1.89%). According to [16] water absorption is important in bulking and consistency of products. The oil absorption capacity (OAC) of unripe *cardaba* (2.78%) was higher than the unripe *bluggoe* (2.33%). Oil gives soft texture and flavour to food, and the absorption of oil by food products improves mouth feel and flavour retention. The high oil absorption capacity suggested the lipophilic nature of the flour constituents, since oil absorption is attributed to the physical entrapment of the oil[17].The wettability of unripe *cardaba* (60.66secs) was higher than unripe *bluggoe* (59.66secs). Wettability is the time required by flour to reach its wetness. The foam capacity (FC) of unripe *cardaba* (12.78%) was lower than that of unripe *bluggoe* (13.78%). According to [18], the foam capacity in a flour makes it to be added to a food system such as bakery products and also functional agent in information such as ground meat.

The result also showed that foam stability of unripe *bluggoe* (7.42%) is higher than that of unripe *cardaba* (6.08%). Good foam stability and retentions are desirable attributes for flours intended for the production of a variety of food products such as cakes, cookies, fudges, akara and so on [19] . The gelation capacity of unripe *bluggoe* (0.74%) was higher than that of unripe *cardaba* (0.53%). Gels enhance the body and texture of a product, and their primary function in foods such as meat curds to bind the free water in the food. Seed coat fractions in flour proteins interfere with the formation of gels [19].

The emulsion capacity of unripe *cardaba* (21.46%) was higher than that of unripe *bluggoe* (20.30%). High emulsion capacity is an indication that the flour can act as an excellent emulsifier in various foods [20].The swelling index of unripe *cardaba* (1.14) was shown to be higher

than that of unripe *bluggoe* (0.92). High swelling capacity has been reported as part of the criteria for good quality products [21].

Table 2: Mean value of the functional properties of cooking banana

Sample	BD g/ml	WAC	OAC	WETTS (S)	FC (%)	FS (%)	GC (%)	FC (%)	SI
URC	0.79[a]± 0.02	1.89[a]± 0.10	2.78[a] ±0.09	60.66[a] ±1.15	12.97[a] ±0.34	6.08[a] ±0.18	0.53[a] ±0.01	21.46[a] ±0.01	1.14[a] ± 0.04
URB	0.74[a]± 0.03	1.93[a]± 0.06	2.30[b] ±0.20	59.66[a] ±0.57	13.78[a] ±0.38	7.42[a] ±0.15	0.74[a] ±0.03	20.30[a] ±0.15	0.92[b] ±0.09

Means with different superscript are significantly different ($p>0.05$)

Key:

BD Bulk density
WAC Water absorption capacity
OAC Oil absorption capacity
WETTS Wettability
FC Foam capacity
FS Foam stability
EC Emulsion capacity
SI Swelling index

IV. Conclusion

This study focused on the proximate composition and functional properties of cooking banana flour. The proximate composition of cooking banana flour showed that they are rich in carbohydrate. The result from proximate composition obtained confirm the feasibility of producing starchy flour from cooking banana ranging from 78.85 to 79.88% of carbohydrate, and with low moisture content ranging from 10.00 to 10.34% for a stable shelf life. Functional properties also indicated there were significant effect in oil absorption capacity and swelling index of the two varieties of cooking banana flour. It also revealed that bulk density ranged from 0.74% to 0.79%, water absorption capacity ranged from 1.89 to 1.93%, oil absorption capacity ranged from 2.30 to 2.78%, while wettability ranged from 59.66 to 60.66 secs.

References

[1]. R.H. Strosse, H. Schoofs, B. Parries, F. Andre, Reyrersk. and R. Swennen, Development of embryogenic cell suspensions from short meristematic tissue in Banana and Plantains (Musa spp) Plant Sci. 170: 2006, 104-112.

[2]. S. Chandler, The Nutritional value of banana. In: Banana's and plantain S. Gowen (ed). Chapman and Hall, London, 1992, 469.

[3]. PBIP , Plantain and Banana Improvement Program 1994, Annual Report Crop Improvement Division(International Institute of Tropical Agriculture, Nigeria, 1995).

[4]. P.O. Ogazi, Plantain: Production, Processing and Utilization, (Puman and Associates Ltd, Okigwe, 1996).

[5]. AOAC ,Official method of analysis (14th edition) Association of Official Analytical Chemist, (Washington DC. 1990).

[6]. C.S. James, Analytical Chemistry for Foods Blackie (Academic and Professional, New York, 1995).

[7]. B.O. Okezie, and A.E. Bello, Physico-chemical and functional properties of winged bean flour and isolate compared with soy isolate, Journal of Food Science, 53,1998 450-455.

[8]. B.M. Careea, Functional properties Drum-Dried (Cier arietinum L.) Flours, Journal of food sci, 51,1986, 1518-1526.

[9]. R.S.D. Steel and J.H. Torrie, Principles and Procedures of Statistics, a biometric approach, (Mac-Graw Hill Book Company, New York,1980).

[10]. T.U. Nwabueze, Water absorption and solubility indices of extruded African breadfruit (Treculia Africana) blends, Journal of Food Technology., 4, 2006b,64-69.

[11]. S. Sefa-Dedeh, and F.K. Saailia ,Extrusion of maize-cowpea blends in modified oil expella, Journal of the Science of Food and Agriculture, 73, 1997,160- 168.

[12]. C.J. Peterson, V. B. Johnson, and P. J. Mattern , Influence of cultivar and environment on minerals and protein concentration of wheat flour, bran and grain, cereal Chemistry, 63: 1986,183-186.

[13]. N.L Kent and A. Evers, Technology of Cereals, An introduction for student of Food Science and Agriculture. 1994, 4th ed.

[14]. A.U. Osagie, and O. U. Eka , Nutritional Quality of Plant Foods, Postharvest Research unit, (University of Benin, Benin City, Nigeria,(1998).

[15]. A.A. Adebowale, S.A. Sanni, F.O. Oladapo, ,Chemical, Functional and Sensory properties of instant yam breadfruit flour. Nig. Food Journal, 26(1) 2008, 2-12.

[16]. L.L. Nibia, M. Bokanga, F.I. Jackson, D.S Schlimme and B.W. Li, Physicochemical properties and starch granular characteristics of flour from various Manihot esculenta (cassava), genotype. J.ed. Sci, 67, 2001, 1701.

[17]. J.E. Kinsella, Functional properties of protein in foods, A survey Journal of Food Science Nutrition (7) ,1976, 219-280.

[18]. A. Terek El-Adawy, and K.M. Taha, Characteristics and composition of water melon, pumpkin and parika seed oils and flows, Journal of Agricultural Food Chemistry, 49(3),2001, 1253-1259.

[19]. A.I. Onimawo, and K.M. Egbekun, Comprehensive Food Science Nutrition,(Ambik press Ltd., Benin City,1998).

[20]. E.N.T. Akobundu, J.P. Cherry, J.G. Simmonds, Chemical, Functional and Nutritional Properties of Egusi (Coloeynthis citrullus L.) seed protein products, Journal of food Science 47 (3), 1982, 829-835.

[21]. S.C. Achinewhu, L.I. Barber, and I.O Ijeoma, Physico-chemical properties of garrification of selected Cassava cultivars in Rivers State Plant Food Human Nutrition, 52, 1998,133-140.