EVALUATION OF NUTRITIONAL VALUES IN RIPE, UNRIPE, BOILED AND ROASTED PLANTAIN (*Musa paradisiacal*) PULP AND PEEL

Adamu, A. S.
Department of Chemistry
College of Education
Ikere Ekiti
NIGERIA

Ojo I. O.
Department of Chemistry
College of Education
Ikere Ekiti
NIGERIA

Oyetunde, J. G.
Department of Chemistry
College of Education
Ikere Ekiti
NIGERIA

ABSTRACT

Evaluation of nutritional values in ripe, unripe, boiled and roasted plantain pulp and peel was carried out. The proximate analysis shows that the moisture contents in all the samples ranged between 58.24% (ripe plantain pulp) and 53.30% (ripe plantain peel). The ash content which is very important in determining mineral content had the highest value (6.30%) in ripe plantain peel and the least (1.00%) was recorded in unripe plantain peel. Relatively low fat content was obtained in nearly all the samples with the highest in unripe plantain pulp (6.69%). Crude fibre was between the range of 5.61% (boiled unripe plantain pulp) and 5.05% (roasted unripe plantain pulp). The ripe plantain peel had the highest protein content (6.69%) while the least (2.93%) was recorded in unripe plantain peel. The highest carbohydrate content (55.20%) was found in roasted unripe plantain pulp. Unripe plantain peel almost had the highest value of minerals among all the samples with: Fe (89.50 mg/kg), Ca (181.28 mg/kg), Mg (34.50 mg/kg), Mn (4.45 mg/kg) and followed by ripe plantain peel as shown in Table 2. Cu was not detected in any of the samples.

Keywords: Evaluation, plantain, minerals, plantain, pulp and peel.

INTRODUCTION

Plantain and cooking banana belong to the family *Musaceae* and the genues *Musa*, tree like perennial, 2 – 9 inch tall, with an underground rhizome. They can be differentiated by the number of fingers in the bunch, a characteristics used in naming the fruit in many parts of southern part of Nigeria (Makanjuola et al., 2013). The origin of cultivated plantain and banana is from two wild diploid species: *Musa acuminate* and *Musa balbisiana* which have the genome as AA and BB respectively (Falana, 1977). Raw green plantains can only be eaten after cooking, each fruit measures about 3 to 10 inches or more in length depending upon the cultivar type. They tend to have coarser external features with prominent edges and flat surface (http.//www.nutrition-and-you.com/banana-fruit.html). *Musa paradisiacal* (plantain) is a major starchy staples in the sub-Saharan Africa both for rural and urban populace, providing more than 25% of the carbohydrate and 10% of the daily calorie intake for more than 70 million people in the continent (Kayode, et al., 2013). Over 2.11 million metric tons of plantains are produced in Nigeria annually which contributes substantially to the nutritional of subtropical local population (Akinsanmi, 2015). The plant is a source of food, beverages, fermentable sugars, medicines, flavouring, cooked foods, silage, fragrance, rope, cordage, garlands, shelter, clothing, smoking material and numerous ceremonial and religious uses (Nelson et al., 2006). Plantain flowers, ripe fruit, unripe fruit, leaves and stem extract and its active constituents have been used for the treatment of a large number of human ailments (Auta and Kumurya, 2015). The main pharmacological effects of this plant

are: hepatoprotive, diuretic, analgesic, anti-ulcer, wound healing, hair – growth promoter and haemostatic activity (Kumar et al., 2012).

MATERIALS AND METHODS

Freshly harvested plantain cultivars at matured green level were purchased from *Oba's* market in *Ikere, Ekiti* State, South-West Nigeria. Some were left for some days to ripe.

Proximate Analysis

The proximate parameters (moisture, ash, crude fat, crude fibre, crude protein and carbohydrate) contents were determined using the procedure described by AOAC, 1990. The moisture content was determined using an AND-MF-50 moisture analyzer at 105^{o}C. The moisture content in each of the samples was determined by weighing 3g of each sample into a pre-weighed aluminium dry dish, the samples were dried to a constant weight in the moisture analyzer at 105^{o}C for about 45 minutes and then the moisture was read and recorded. The ash content was determined for all the samples by the incineration of the samples placed in a muffle furnace maintained at 550^{o}C for 5 – 8 hours while the crude fibre obtained by digesting 2g of the samples with H_2SO_4 and NaOH and incineration the residue in a muffle furnace maintain at 550^{o}C for 5 – 8 hours. The crude protein (% total nitrogen x 6.25) was determined by kjeldahl method, using 2g of each sample. The crude lipid content was also determined by exhaustively extracting 10g of each sample in a soxhlet apparatus using n-hexane as the extracting solvent and the carbohydrate content was determined by deducting the total percentage of moisture, ash, fibre, fat and protein from 100.

Mineral Analysis

The mineral analysis was carried out using standard methods as described by Pearson, 1976. The samples were dry ashing at 550^{o}C to constant weight and dissolved the ash in volumetric flasks with de-ionized water with a few drops of concentrated HCl. The sample solutions were stored for mineral analysis using Atomic Absorption Spectrophotometer (AOAC, 1990).

RESULTS

The proximate composition of the samples is shown in Table 1 while Table 2 shows the results of the mineral analysis of the samples.

Table 1: Proximate Analysis of the Samples

S/N	Parameters	Amount (%)					
		Ripe Plantain Pulp	Unripe Plantain Pulp	Boiled Unripe Plantain Pulp	Roasted Unripe Plantain Pulp	Ripe Plantain Peel	Unripe Plantain Peel
1	Moisture Content	58.24	36.66	36.10	31.07	53.30	33.53
2	Ash Content	3.10	1.20	3.69	3.28	6.30	1.00
3	Fat Content	1.30	6.69	1.40	1.66	1.40	6.00
4	Crude Fibre	3.53	2.89	5.61	5.05	3.71	2.53
5	Protein Content	3.50	5.14	3.82	3.74	6.69	2.93
6	Carbohydrate Content	30.33	47.42	49.38	55.20	28.60	54.01

Table 2: Mineral Analysis of the Samples

S/N	Mineral	Concentration (mg/kg)					
		Ripe Plantain Pulp	Unripe Plantain Pulp	Boiled Unripe Plantain Pulp	Roasted Unripe Plantain Pulp	Ripe Plantain Peel	Unripe Plantain Peel
1	Fe	12.40	33.45	9.90	6.55	79.00	89.50
2	Ca	141.60	132.40	59.40	113.60	154.80	181.28
3	Mg	34.25	34.30	29.00	29.75	34.80	34.50
4	Mn	0.50	2.20	3.05	2.20	3.65	4.45
5	Zn	4.65	13.35	1.00	1.40	3.10	3.70
6	Cu	ND	ND	ND	ND	ND	ND

ND = Not detected

DISCUSSION

Proximate Analysis

In Table 1, the highest moisture content was recorded in ripe plantain pulp and peel as 58.24 and 53.30% respectively while unripe plantain pulp, boiled unripe plantain pulp, roasted unripe plantain pulp and unripe plantain peel had relatively the same moisture content as 36.66%, 36.10%, 31.07% and 33.53% respectively. Moisture content is very essential for life maintenance and analysis of it is one of most widely used measurements which determine the way the food will be processed and its self life (Akinsanmi et al., 2015) and also had been used as a measure of stability and susceptibility to microbial contamination (Davey, 1989). The significant high level of the moisture content in the ripe pulp and peel of the plantain samples might have been as a result of moisture gain from atmosphere or from microbial activities during the riping period. The highest ash content was recorded in ripe plantain peel (6.30%) followed by roasted unripe plantain peel (3.28%) and ripe plantain pulp had (3.10%) and the least was found in unripe peel (1.00%). The highest fat content was found in unripe plantain pulp (6.69%) and in unripe plantain peel (6.00%) too. The crude fibre ranged between 5.61% (boiled unripe plantain pulp) and 5.05% (roasted unripe plantain pulp). The ripe plantain peel (6.69%) reported to have the highest protein content next was unripe plantain pulp (5.14%), the highest content of protein in these two samples compared to others indicates that these samples can contribute immensely to the daily human protein requirement (Adamu et al, 2016). The highest amount of carbohydrate content was observed in roasted unripe plantain pulp (55.20%) and also in unripe plantain peel (54.01%) while the rest of the samples have almost the same range of carbohydrate contents.

Mineral Analysis

In Table 2, ripe and unripe plantain peels had the highest Fe of 79.00 mg/kg and 89.50 mg/kg respectively while ripe and unripe plantain pulp had 12.40 mg/kg and 33.45 mg/kg respectively. The lowest amounts was reported in boiled and roasted unripe plantain pulp as 9.90 (mg/kg) and 6.55 mg/kg respectively. This low content of Fe in boiled and roasted unripe plantain pulp might have been to the loss of Fe concentration to the heat of boiling and roasting. Relatively high amount Ca was reported in all the samples compared with other minerals investigated, meanwhile calcium and phosphorus are associated with each other for growth and maintenance of bones, teeth and muscle (Clark, 2008). It has been reported that magnesium is a component of chlorophyll and it is an important content in connection with

ischemic heart disease and calcium metabolism in bones (Bergman et al., 2009). Mg in the present study ranged between 29.00 (mg/kg) in boiled unripe plantain pulp and 34.80 (mg/kg) in ripe plantain peel. Relatively low concentration of Mn and Zn was reported for nearly all the samples and Cu was not detected in any of the samples.

CONCLUSION AND RECOMMENDATIONS

It was observed that there was high percentage of protein in ripe plantain pulp, Fe and nearly all other minerals except Zn were present in higher quantities in peels of ripe and unripe plantain compared with that observed in the pulp. Therefore it could be recommended that the peel should be ground into fine powder and use it to fortify plantain pulp flour to increase its nutritional value.

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