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# Preliminary Quality Evaluation of Selected Plantain Flour (Musa Paradisiaca) Sold in Port Harcourt Markets, Nigeria

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**Abstract**
Post harvest loss is a major problem limiting the production of plantain. In recent years, farmers and plantain processors have adopted processing of plantain into flours as a means of market diversification and consequently curtailing glut. This made different varieties of plantain flour with diverse nutritional composition to be sold in the markets. This preliminary study therefore aimed at evaluating the quality of selected plantain flour sold in Port Harcourt markets, Nigeria. In this study, selected physico-chemical analyses were evaluated. The moisture content, crude protein, starch, fat content and bulk density of the plantain flour samples used ranges between 7.20% - 13.92%, 4.75% - 9.84%, 60.41% - 67.85%, 0.84 % - 1.22% and 0.64g/ml – 0.73g/ml respectively. The samples were stored for four months. No insect infestation was observed during the storage period but mould growth was observed by the fourth month in all the samples except the reference sample.
**Keywords***:* Plantain flour, quality evaluation, shelf life, nutritional composition

## 1.Introduction

Plantain (*Musa paradisiaca*) belongs to the genus *Musa* in the family *Musaceae*. It is a giant perennial herb and cultivated in many tropics and subtropical countries of the world. It ranks third after yam and cassava for sustainability in Nigeria (Akomolafe & Aborisade,2007). It is used as a source of starchy staple food for millions of people in Nigeria. Mature plantain pulp is rich in iron, potassium and vitamin A but low in protein and fat (Adeniji et al, 2006). The water content in the green plant is about 61% and increases in ripening to about 68%. The increase in water is presumably due to the breakdown of carbohydrates during respiration. The starch in the unripe plantain is mainly amylase and amylopectin and this is replaced by sucrose, fructose and glucose during the ripening stage due to the hydrolysis of the starch (Zakpaa et al, 2010). The chemical composition of plantain varies with the variety, maturity, degree of ripeness and where it is grown (soil type). When processed into flour, it is used traditionally for the preparation of gruel, which is made by mixing the flour with appropriate quantity of boiling water to form a thick paste (Mepba et al, 2007). Most plantain foods are eaten as boiled, fried or roasted. Unripe plantain meal is usually consumed by diabetics to reduce postprandial glucose level. This is because the propensity of individual to develop diabetes and obesity is due to the increased consumption of carbohydrate-rich foods with a high glycemic index (Oboh &Erema, 2010). Pere-Sira (1997) had also indicated the use of plantain flour as a component of baby food. The proximate content, functional characteristics and properties of starch of ripe and unripe plantains have been evaluated (Izunfuo, 2006; Osundahunsi, 2009). The processing, utilization and effect of storage of plantain has also been reported (; Niba, 2004; Onwuka & Onwuka, 2005.

Post harvest loss is a major problem limiting the production of plantain and banana in Africa due to unavailability of established storage conditions that can guarantee longer shelf life (Wills et al, 1989; Olorunda & Adelusola,1997). Traditionally, chips are often dried at road sides, displayed in markets in open containers to attract potential buyers and stored in sacks that are susceptible to insect infestation. Plantain and banana flour are currently on sale in some parts of Nigeria. These sales are strong indication that farmers and plantain processors are beginning to adopt processing options as a means of market diversification and consequently curtailing glut (Adeniji et al,2007). There are different varieties of plantain flour sold in Port Harcourt markets, sometimes with different nutritional labels and colour. This occurrence initiated this research work, which was aimed at evaluating the quality of selected plantain flour sold in Port Harcourt markets, Nigeria.

## 2.Materials And Methods

Four different plantain flour samples (B, C, D, E) were purchased randomly from four markets and four supermarkets in Port Harcourt, Nigeria. Two packs of each sample were bought from each market. Plantain flour was produced in Nigerian Stored Products Research Institute (NSPRI) Port Harcourt, Nigeria as a reference sample (sample A).

### 2.1 Preparation of Plantain Flour

Green mature plantain fruits were washed to remove adhering soil particles, peeled and sliced into 3mm thickness with a stainless steel knife. The slices were dried in the NSPRI multipurpose dryer at 60$^{o}$C for 18hours.

 

The dried plantain slices were milled with hammer mill, sieved through 250µm aperture sieve, packed and sealed in polyethylene bags.

The different plantain flour samples were stored at 28±3°C and relative humidity of 83±3% on the laboratory shelves for four months.

2.2 Physico-chemical Analysis

Selected physico-chemical analysis (moisture content, crude protein, crude fat, starch and bulk density) were carried out on the different plantain flour samples during the period of storage using A.O.A.C (2000). Insect infestation was also determined.

2.3 Statistical Analysis

Statistical analysis was done on the data obtained during the storage period using one-way analysis of variance (ANOVA) at 5% level of significance and the means separated by Duncan Multiple Test, using SPSS 16.0 software package.

**3. Results And Discussion**

The initial moisture content of the plantain flour samples were between 7.20% ±0.141 and 13.92% ±0.021 with sample A (reference sample) having the least value (Table 1). Only sample A is within the range of safe moisture content (≤ 11.1%) for plantain flour as reported by Daramola and Osanyinlusi (2006) and Ogazi (1992). This might be due to the fact that sample A was just freshly prepared while other samples were not. The lower the moisture content in a product, the longer the potential storage life since the growth of microorganisms and food spoilage agents are hindered at such low moisture content (Adeniji et al,2007). The moisture content of all the samples slightly increased during the storage period, which might be due to the weather condition (80% - 92% relative humidity) Although the production time of samples B, C, D, E were not put into consideration during the purchase, the moisture content of sample A significantly differed ($p \leq 0.05$) from samples B, C, D, E (Table 3). The least value of crude protein (4.75% ±0.028) was sample A while sample D has the highest value (9.84% ±0.028). Eleazu et al (2011) and Adeniji et al (2007) also reported low protein content (3.15% and 4.61% respectively) in plantain flour. Since a healthy adult needs about 0.75g of protein per kg per day, unripe plantain diet alone cannot meet adult protein diet need. The protein content slightly decreased during the storage period. Samples A and C are not significantly different ($p \leq 0.05$) in protein content (Table 3).

The fat content of the plantain flour samples were within the range of 0.84% ±0.014 and 1.22% ±0.028 (Table 1) though these values decreased during the storage period. The low level of fat in plantain flour as reported by Zakpaa et al (2010) and Adeniji et al (2007) – 0.34% and 1.47% respectively is an indication that fat do not contribute much to the energy content. It also gives a higher probability of a longer shelf life in terms of the onset of rancidity (Chukwu et al, 1998). The fat content of sample C differed significantly ($p \leq 0.05$) from other samples. There was reduction in the bulk densities of the plantain flour during the storage period which was between 0.43g/ml ±0.007 – 0.73g/ml ±0.007. These values are comparable to that obtained for sweet potato powder (0.745g/ml) which is used as a thickener or base in foods like yoghurt (USDA, 2009). This suggests that plantain flour can be used as food thickener in the food industries and drug binders in pharmaceuticals (Zakpaa et al, 2010; Eleazu et al 2011). There was no significant difference in the bulk densities of all the plantain flour samples. No insect infestation was observed throughout the storage period but mould growth was observed by the fourth month in all the samples except in Sample A. This might not be unconnected with the higher moisture contents of all the samples compared to sample A. From the subjective physical assessment of the colour of the plantain flour samples (Table2), sample A has yellowish cream colour with very faint black spot, which is peculiar with plantain. Other samples had colour variations like whitish cream and brownish cream colour with more visible black spots. These variations might be due to possibility of uncontrollable enzymatic reaction during processing or possibility of presence of other food materials apart from unripe plantain.

**Table 1 Quality Parameters of Selected Plantain Flour Samples Sold In Port Harcourt Markets**

| Brand | Moisture Content(%) | Crude Protein(%) | Starch Content(%) | Crude Fat(%) | Bulk Density(g/ml) | Insect Infestation |
|---|---|---|---|---|---|---|
| **Sample A** | 7.20±0.141 | 4.75±0.028 | 67.85±0.064 | 0.85±0.050 | 0.73±0.007 | Nil |
| **Sample B** | 13.92±0.021 | 6.97±0.028 | 66.12±0.000 | 0.89±0.028 | 0.65±0.007 | Nil |
| **Sample C** | 12.72±0.021 | 4.93±0.028 | 60.41±0.021 | 1.22±0.028 | 0.64±0.000 | Nil |
| **Sample D** | 12.97±0.028 | 9.84±0.028 | 63.38±0.050 | 0.64±0.007 | 0.64±0.007 | Nil |
| **Sample E** | 11.64±0.021 | 7.85±0.021 | 61.47±0.000 | 0.67±0.000 | 0.67±0.000 | Nil |

 

**Table 2 Physical Assessment of Colour of Plantain Flour Samples**

| Brand | Colour of Plantain Flour |
|---|---|
| **Sample A** | Yellowish cream, faint visible black spots |
| **Sample B** | Faint yellowish cream, little visible black spots |
| **Sample C** | Whitish cream, little visible black spots |
| **Sample D** | Brownish cream, more visible black spots |
| **Sample E** | Brownish cream, little visible black spots |

**Table 3 Mean Score of Quality Parameters of Plantain Flour Samples During Storage**

| Brand | Moisture Content(%) | Crude Protein(%) | Starch Content(%) | Crude Fat(%) | Bulk Density(g/ml) |
|---|---|---|---|---|---|
| **Sample A** | $8.27^{c}$ | $4.53^{d}$ | $63.30^{a}$ | $0.73^{b}$ | $0.62^{a}$ |
| **Sample B** | $14.41^{a}$ | $6.69^{c}$ | $64.07^{ab}$ | $0.74^{b}$ | $0.53^{a}$ |
| **Sample C** | $14.16^{a}$ | $4.77^{d}$ | $56.31^{c}$ | $1.08^{a}$ | $0.54^{a}$ |
| **Sample D** | $14.19^{a}$ | $9.67^{a}$ | $59.95^{bc}$ | $0.68^{b}$ | $0.54^{a}$ |
| **Sample E** | $12.09^{b}$ | $7.38^{b}$ | $60.15^{abc}$ | $0.76^{b}$ | $0.61^{a}$ |

Samples with the same number of superscript are not significantly different at 5%probability level.

## 4 Conclusion

From the preliminary study, it was observed that some varieties of plantain flour sold in Port Harcourt markets in Nigeria do not have the actual nutritional composition as they claim on their labels, although the production time was not put into consideration in this study. Moisture content, which is a key determining factor in shelf life of plantain flour was high in all the samples except the reference sample. The regulatory bodies of processed foods should intensify effort in ensuring that food manufacturers follow standard procedures. It should also be ensured that the nutritional claims on food labels are actually obtainable in the food samples in order to give consumers value for their money.

## 5 Recommendation

Further work should be done on quality evaluation of more varieties of plantain flour samples in Rivers State and the six geo-political zones in the country, putting into consideration factors like production time, plantain species, storage period and many more.

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