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Comparative Analysis of Ripe and Unripe Plantain Flour Fortified with Dried Catfish Powder

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ABSTRACT

This study evaluated the sensory properties of plantain flour produced from blends of ripe and Unripe Plantain with dried catfish powder. The results obtained showed that T_5 (100% ripe plantain) contained the highest percentage of protein (33.87 _+0.035) and carbohydrates content (68.07 -+ 0.02) with the least percentage ash (0.045 -+ 0.03) and lipid (0.60 -+ 0.01). The highest percentage moisture of 7.38 -+ 0.04 was recorded in T_6 (90% ripe plantain + 10% catfish powder). The highest microbial load recorded was T_5 (1.41×10^1), while the least was 1.01×10^1 in T_3 (80% unripe plantain flour + 20% catfish powder). The result of the overall acceptability placed T_1 at the top of others with 5.88 -+ 2.93 and T_7 and T_8 atthe bottom with 3.88 -+ 2.17. The result of the analysis of variance (ANOVA) conducted for the sensory evaluation analysis showed that there was a significant difference in the treatments measured for each of the parameters considered in this study (i.e. $P < 0.05$).

KEYWORD: Acceptability, Analysis, Blends, Catfish, Evaluation, Powder, Plantain, Sensory

I. INTRODUCTION

According to Abioye et.al (2011), Nigeria is faced with the problem of malnutrition caused by protein-calorie deficiency and this problem can be solved by incorporating food sources rich in protein in the diet. Cassava, sweet potatoes and plantain are among major starch crops used in many tropical countries. (F.A.O, 1990).

In Nigeria, plantain is mainly consumed as snacks in the form of chips and in recent time it is included in weaning diet and in the preparation of composite flour. Plantain is a well-known staple food and its popularity resulted from its versatility and nutritional component. It is a starchy food which can be used either ripe or unripe. In Nigeria, and some other West African countries, unripe plantain is processed into flour and the processed flour undergo further processing with boiling water to produce a locally made elastic paste called amala (Abioye et.al 2011). The Amala is consumed with different traditional soups, especially draw soup (ewedu). Recently, researchers in developing countries such as Nigeria have focused attention on the improvement of the nutritional value of cereals and tubers. These researchers have dived into different areas and degrees of fortification of cereals and tubers. Some of the areas of research include the fortification of cassava with soy-flour, yam flour with Moringa leaves (Karim et.al, 2015). Plantain with soyflour (Soy-plantain flour) (Adako et.al, 2016).

Ogazi et.al (1996), who researched on the development of soybeans plantain baby food, reported that plantain alone cannot meet up with daily protein requirement, so he suggested that protein supplementation is essential.

According to Abioye et.al (2011), incorporating soy-flour into plantain flour may change the physiochemical properties of the flour and its acceptability when produced into Amala (tick paste). The study tends to carry out the comparative analysis of flour produced from plantain (ripe and unripe) fortified with dried catfish powder, nutritional value and the overall acceptability.

Fish is an essential source of animal protein in the diet of human and it is consumed by most Nigerians as opined by Olayemi et.al (2011). Ogbonaya et.al (2009), believed that despite the

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fact that smoked or dried fish is a traditional part of the diet of a large section of the world's population, there is a wide gap between demand and supply of fish due to increase in population, poor handling after harvest, lack of essential facilities for processing and storage.

The study evaluated the effect of dried catfish as fortificant to both ripe and unripe plantain flour and examined the overall acceptability of Amala that was produced from the flour mixture. Specifically, the studydetermine the amino acid content and cholesterol level of plantain and dried catfish and the chemical, physical, microbial and sensory qualities of flour produced from plantain flour and the blend mixture. This study will be useful to individual consumer, institution offering food related courses, restaurants and hotels that produce and serve foods to different group of consumers from all works of life.

II. MATERIALS AND METHODS

The major materials used for this research work were both ripe and unripe plantain and dried catfish. Freshly harvested unripe plantain were obtained in a farm in Oba, Ogun State and fresh catfish from Modupe Fish Farm in Lagos. The area of study was Moshood Abiola Polytechnic and its environs where the taste panel were selected.

2.1 Preparation of Unripe Plantain and Ripe Plantain Flour

Unripe plantain flour was prepared as described by Karim (2015), with little modification. Briefly, the finger of the unripe plantain was removed, rinsed in clean water and it was peeled with knife. Then the already peeled plantain was cut into slices and blanched for 5 minutes to suppress the action of enzymes, it was dried at 60^0C for 24 hours in a hot air oven. This was followed by milling the dried plantain into powdered form and it was sieved into flour. The flour was then poured into an airtight container (well covered container). The unripe plantain purchased was divided into two parts. One part was used for the preparation of unripe plantain flour, while the other part was wrapped in a sack between 2 and 7 days for the ripening process. The ripe plantain went through the same process adopted in the preparation of the unripe plantain flour.

2.2 Preparation of Dried Catfish Powder

The fresh catfish was slaughtered and cleaned. The cleaning process entails the removal of the inedible parts of the fish and thorough washing in salted water, which was carried out several times until it is well cleaned. The cleaned fish was oven dried at 60^0C for 48 hours. Then milled into powdered form, this was followed by sieving and it was stored in an airtight container before it was used for fortification.

2.3 Blend Formulation

Blends of unripe plantain flour and dried catfish powder were prepared by thorough mixing of each of the samples in the proportion of 100:0, 90:10, 80:20, and 70:30. Another four flour blends were prepared from the combination of ripe plantain flour and dried catfish powder using the same proportion used for the unripe plantain blends. These mixture was mixed together thoroughly. Each of the samples were stored in a labelled airtight container.

2.4 Preparation of Amala

The Amala was prepared from each samples by stirring and adding flour blend slowly into a pot of boiling water until it is thickened. The mixture was stirred rapidly and continuously with a wooden ladle as the blend is added to avoid lumps. Then little water was added, covered and allowed to cook for 15 minutes. It was then stirred again until it is smooth and elastic to form soft dough. It was then removed from the flame and each of the samples was served to the panelists.

III. PROXIMATE ANALYSIS OF THE BLEND

Proximate compositions including moisture, ash, crude protein, crude fat or the raw, processed and fortified mixture were determined by the standard methods of Adako et.al (2016).

3.1 Determination of Moisture Content

Moisture was determined by oven drying methods, 1/5g of well mixed sample was accurately weighed in a clean dried crucible (W_1). The crucible was allowed in an oven at 100-150^0C for 6-12 hours until a constant weight was obtained. Then the crucible was placed in the desiccator for 30 minutes to cool.

After cooling, it was weighed again (W_2). The percent moisture was calculated using the following formular.

% Moisture $\frac{W_1 - W_2}{\text{Weight of sample}}$

W1 = Initial weight of crucible + Sample.

W2 = Final weight of crucible + Sample

3.2 Determination of Ash

To determine the ash content, clean empty crucible was placed in muffle furnace at 550^0C for 2-4 hours. The appearance of gray white ash indicated complete oxidation of all organic matter in the sample. After ash furnace was switched off. The crucible was cooled and weighed (CW3). Percent ash was calculated using the following formula.

$$\% \text{ Ash} = \frac{\text{Differenceinweightof Ash}}{\text{Weightofsample}} \text{ X } 100$$

Difference in weight of ash = W_3-W_1

3.3 Determination of Crude Fat

Dry extraction method for fat determination was used. Dry samples were extracted with some organic solvent. Fat was determined with some intermittent solvent apparatus. Approximately 1g of moisture free sample was wrapped in filter paper, placed in fat free thimble and then introduced into the extraction tube. The receiving beaker was then weighed, cleaned and dried and it was filled with petroleum ether and fitted into the apparatus. Water and heater were turned on to start the extraction. After 4-6 siphoning ether was allowed to evaporate and beaker was disconnected before the last siphoning. The extract was transferred into clean glass dish. Then the dish was placed in an oven at 105^{0}C for 2 hours and it was allowed to cool in a desiccator. The percent crude fat was determined by using the formula stated below:

$$\% \text{ Crude fat} = \frac{\text{WeightofExtract}}{\text{WeightofSample}} \text{ X } 100$$

3.4 Determination of Crude Fibre

A moisture free and ether extracted sample of crude which was made up of cellulose was digested with dilute H_2S0_4 and then with dilute KOH solution. The undigested residue was collected after digestion and ignited and loss in weight after ignition was registered as crude fibre.

$$\% \text{ Crude fibre} = \frac{W1-W2}{W0} \text{ X } 100$$

3.5 Determination of Crude Protein

Protein in the samples was determined by Kjeldahl method using the following formula.

% crude protein= 6.25* X %N (*Correlation factor).

IV. MICROBIOLOGICAL ANALYSIS

The microbial analysis of the sample was carried out according to the method described by (Harrigan et.al 1976). Appropriate dilution of the samples was enumerated for counts of bacterial and yeast using nutrient agar, sabour and dextrose agar base. Inoculated plates were counted and expressed as colony forming units (CFU/g), colonies of bacteria and yeast were isolated and sub-cultured to obtain pure cultures.

V. SENSORY EVALUATION

The sensory evaluation of Amala that was produced from the sample at varying proportion was carried out using 25 panelists consisting of students and staff of Moshood Abiola Polytechnic, Abeokuta Ogun State, Nigeria.

VI. STATISTICAL ANALYSIS

The data that were obtained were subjected to analysis of variance (ANOVA) and Duncan Multiple Range Test (DMRT) to determine the data with significant difference between the Amala that were produced from the samples. All tests were conducted at 5% level of significance and carried out using SPSS (VERSION 20) statistical software package.

VII. RESULT AND DISCUSSION

7.1 Proximate Composition of Plantain Flour

Table 1. Proximate Composition of Plantain Flour

Treatment	Protein %	Ash %	Moisture %	Lipid %	Fibre %	Cho %
T1	11.62±.049^a	3.90 ±.08^h	6.59±.02^e	1.19±.02^g	12.53±.05^f	64.18±.09^g
T2	31.91±.034^h	1.91±.02^d	5.42±.07^a	3.04±.12^c	3.89±.04^a	53.85±.10^c
T3	16.59 ±.04^d	0.50 ±.02^b	5.93±.02^c	6.42±.04^d	15.82±.02^h	54.75±.02^d
T4	13.14±.035^b	2.48±.03^e	5.65±.03^b	7.27±.03^f	14.06±.03^g	57.42±.04^f
T5	33.87±.035^c	0.45±.03^a	7.36±.09^g	0.60±.01^h	7.46±.02^c	68.07±.02^h
T6	16.07±.01^g	0.93±.02^c	7.38±.04^h	4.21±.02^a	9.38±.02^d	49.80±.06^a
T7	25.49±.04^f	3.27±.04^g	7.22±.01^f	5.36±.02^b	6.79±.02^b	51.89±.09^b
T8	17.84±.03^e	2.96±.02^f	6.34±.01^d	6.96±.04^e	10.69±.03^e	55.22±.04^e

Source: Researchers Computation from SPSS 20

Note: Mean values with the same superscript in each column are not significantly different from each other (P > 0.05)
Note: T1=100% unripe plantain
T2=90% unripe plantain and 10% catfish powder
T3=80% unripe plantain and 20% catfish powder
T4=70% unripe plantain and 30% catfish powder
T5=100% ripe plantain
T6=90% ripe plantain and 10% catfish powder
T7=80% ripe plantain and 20% catfish powder
T8=70% ripe plantain and 30% catfish powder

The result of the analysis of variance (ANOVA) conducted showed that there was a significant difference in the treatments measured for each of the parameters considered in this study (i.e. P < 0.05). This leads to the rejection of the null hypothesis that treatments for each of the parameters studied are the same and a conclusion were made that on average the treatment for each of the parameters (moisture, protein, lipid, ash, crude fibre, and carbohydrates) are significantly different from each other.As expected, the ash, protein, fat and crude fibre increased as the percentage of catfish increases, while moisture and carbohydrate increased with increase in plantain flour substitutions.

7.1.1 Crude Protein

All values were significantly different across all treatment (P < 0.05). The protein content for the flour ranged from 11.62 to 33.87 /100g. T_5 recorded the highest value (33.87±.04), however T_2 recorded a value (31.91±.03)compare favorably T_5 (P > 0.05) with T_7 recording (25.49±.04). T_1 recorded the lowest value (11.62±.04). The average crude protein content recorded in this study was 20.12. The protein content of 100% plantain flour 20.12% was comparable to the values 20% obtained by Abioye et al. (2011).

7.1.2 Ash

The ash content for the flour ranged from 0.45 to 3.90. Ash gives an indication of inorganic elements that are present in a food as minerals. Ash contents of the flour blends were high, indicating that the flours were likely to be good sources of mineral elements.

All values were significantly different across all treatment (P < 0.05). From this result, T_1 recorded the highest value 3.90 ±.08 and compare favorably (P > 0.05) with T_7 3.27±.04. However, T_5 0.45±.03 recorded the lowest value. The average ash content recorded for this was 2.05.These differences in ash contents can be attributed to the different locations where the plantain sample was cultivated since it has been reported that gene and environment interactions affects nutritional composition of plant materials Sanni et.al (2008). The average ash content of plantain flour of 2.05 was however lower comparable to the value of 2.43 reported for plantain flour by Adegunwa et al. (2014).

7.1.3 Moisture Content

The moisture content for the flour ranged between 5.42 and 7.38. Moisture provides a measure of the water content and an index of storage stability of the flour. High-moisture products (>12/100 g) usually have shorter shelf stability compared with lower moisture products (<12/100 g), as reported by Ashworth and Draper, (1992). Therefore, the low moisture content of all the flour blends makes them less liable to microbial attack than the raw material (plantain and catfish) and would have longer shelf stability.
All values were significantly different across all treatment (P < 0.05). T_6 recorded the highest value (7.38±.04) followed by T_5 (7.36±.09) which compare favorably (P > 0.05) with T_7 (7.22±.01). T_2 recorded the lowest value (5.42±.07). The average moisture content is 3.48%.

7.1.4 Lipid

The fat content of the composite flour ranged from 0.60 to 7.27). All values were significantly different across all treatment (P < 0.05). In this study, there is clear differences between the values of $T_1$1.19±.02, T_2 3.04±.12, T_3 6.42±.04, T_4 7.27±.03,T_5 0.60±.01, T_6 4.21±.02, T_7 5.36±.02 and T_8 6.96±.04 respectively. T_4 recorded the highest value 7.27±.03 and compared favorably (P > 0.05)with T_8. T_5 recorded the lowest value of 0.60±.01. The average fat content recorded in this study was 4.38. The fat content of 100% plantain flour (4.38) was comparable to be higher to the value of 2.27 reported by Adegunwa et al. (2012).

7.1.5 Crude Fibre

All values were significantly different across all treatment (P < 0.05). The crude fibre content of the composite flour ranged from 3.89 to 15.82. T_3 recorded the highest value 15.82±.02 however, $T_4$14.06±.03 compare favorably with T_3 while T_2 recorded the lowest value 3.89±.04. The average crude fibre content obtained in this study was 10.07. The average crude fibre of plantain flour (10.07) is comparably higher to the values of (3.50) reported by Mepba et al. (2007). Nutritional claims for dietary fibre foods (Official Journal of European Commission, 2012) recommended that for a product to be labelled as "source of fibre" it must contain > 3g dietary fibre/100 g food. Since the flour blends obtained in this study all contain more than 3g dietary fibre/100 g, it implies that the flour blends can be regarded as "source of dietary fibre".

7.1.6 Carbohydrate

All values were significantly different across all treatment ($P < 0.05$). The carbohydrate content of the flour samples ranged from 49.80±.06 to 68.07±.02. T_1 (64.18±.09) compare favorably with T_5 (68.07±.02) with T5recording the highest value. T_6 recorded the lowest value 49.80±.06. The average carbohydrate extract recorded in this report was 56.90.

7.2 SENSORY EVALUATION OF PLANTAIN FLOUR

Table 2. Sensory evaluation of plantain flour

Treatment	Colour	Taste	Flavor	Texture	Consistency	Overall accepatability
T1	7.36±1.89^{b}	6.32±1.97^{bc}	6.20±2.14^{b}	6.28±2.88^{c}	5.84±3.04^{bc}	5.88±2.93^{b}
T2	7.28±1.49^{b}	6.56±1.47^{c}	5.92±1.55^{ab}	6.16±1.79^{c}	5.24±1.92^{bc}	5.80±2.27^{b}
T3	7.32±1.11^{b}	5.52±2.54^{abc}	4.84±1.82^{a}	5.80±1.61^{bc}	5.32±2.21^{bc}	5.04±2.09^{ab}
T4	5.68±2.59^{a}	4.48±2.22^{a}	5.76±1.79^{ab}	4.60±2.16^{ab}	4.44±2.38^{ab}	4.84±1.89^{ab}
T5	5.72±1.93^{a}	5.36±2.12^{abc}	5.24±1.54^{ab}	6.40±2.35^{c}	5.72±2.46^{bc}	5.08±2.18^{ab}
T6	6.24±1.23^{ab}	5.60±2.04^{abc}	5.16±1.55^{ab}	5.60±2.59^{bc}	6.12±2.15^{c}	4.76±2.15^{ab}
T7	5.72±1.67^{a}	4.96±2.49^{ab}	5.68±1.73^{ab}	5.68±1.38^{bc}	5.60±1.53^{bc}	3.88±2.17^{a}
T8	5.32±2.54^{a}	4.72±2.26^{a}	4.68±2.23^{a}	3.60±2.25^{a}	3.16±2.34^{a}	3.88±2.71^{a}

Source: Researchers Computation from SPSS 20
Note: Mean values with the same superscript in each column are not significantly different from each other ($P > 0.05$)

The result of the analysis of variance (ANOVA) conducted showed that there was a significant difference in the treatments measured for each of the parameters considered in this study (i.e. $P < 0.05$). This leads to the rejection of the null hypothesis that treatments for each of the parameters studied are the same and a conclusion were made that on average the treatment for each of the parameters (colour, taste, flavor, texture, consistency and overall acceptability) are significantly different from each other.

7.2.1 Colour

All values were significantly different across all treatment ($P < 0.05$). T_1 recorded the highest value (7.36±1.89) followed by T_2 (7.28±1.49) which compare favorably ($P > 0.05$) with T_6 (6.24±1.23). T_8 recorded the lowest value (5.32±2.5). The average moisture content 33.86% is lower than the previous report of Mousab (2009) 63.00% of a boiled sausage.

7.2.3 Taste

All values were significantly different across all treatment ($P < 0.05$). T_2 recorded the highest value (6.56±1.47), however T_1 (6.32±1.97)compare favorably ($P > 0.05$) with T_5 (5.36±2.12). T_4 recorded the lowest value (4.48±2.22).

7.2.4 Flavour

All values were significantly different across all treatment ($P < 0.05$). In this study, T_1 recorded the highest value (6.20±2.14), however there is little difference between the values of $T_2$5.92±1.55, T_4 5.76±1.79,T_7 5.68±1.73,T_5 5.24±1.54and T_6 15.16±1.55 respectively T_8 recorded the lowest value of 4.68±2.23 and compared favourably($P > 0.05$)

7.2.5 Texture

All values were significantly different across all treatment ($P < 0.05$). From this result, T_5 recorded the highest value 6.40±2.35 and compared favorably ($P > 0.05$) with T_1 6.28±2.88. However, T_3 5.80±1.61 is compared favorably with

$T_7$5.68±1.38 and T_6 5.60±2.59 respectively. However, T_8 3.60±2.25 recorded the lowest value

7.2.6 Consistency

All values were significantly different across all treatment ($P < 0.05$). T_6 recorded the highest value 6.12±2.15, however, $T_1$5.84±3.04 compared favorably with $T_5$5.72±2.46, $T_7$5.60±1.53 while T_8 recorded the lowest value 3.16±2.34.

7.2.7 Overall Acceptability

All values were significantly different across all treatment ($P < 0.05$). T_5 (5.08±2.18) compare favorably with T_3 (5.04±2.09). T_8 recorded the lowest value 3.88±2.17 while the highest value was recorded by T_1 (5.88±2.93) followed by T_2 (5.80±2.27)

7.3 MICRO BIOLOGICAL EVALUATION OF PLANTAIN FLOUR

Table 3. Micro biological composition of plantain flour

	Plate 10^2(cfu/ml)	**Average**	**Plate10^5(cfu/ml)**	**average**	**Plate10^7(cfu/ml)**	
1	9.1x104		$2.7x10^2$		$1.08x10^1$	
1	$8.7x10^4$	8.9x104	2.5x102	2.6x102	$1.01x10^1$	1.05x101
2	$8.1x10^4$		$2.01x10^2$		$1.05x10^1$	
2	$8.18x10^4$	8.14x104	$2x10^2$	2.01x102	$1.5x10^1$	1.3x101
3	$8.0x10^4$		$2.05x10^2$		$1.02x10^1$	
3	8.1x104	8.05x104	$2.1x10^2$	2.08x102	$1.0x10^1$	1.01x101
4	$6.02x10^3$		$1.8x10^2$	$1.02x10^1$		
4	$6.21x10^3$	6.16x103	$1.6x10^2$	1.7x102	$1.24x10^1$	1.13x101
5	$11.5x10^5$		$4.1x10^2$		$1.41x10^1$	
5	$10.9x10^5$	11.2x105	$4.0x10^2$	4.05x102	$1.7x10^1$	1.56x101
6	$11.7x10^6$		$4.2x10^2$		$1.14x10^1$	
6	$10.7x10^6$	11.2x106	$3.9x10^2$	4.05x102	$1.11x10^1$	1.13x101
7	$11.1x10^6$		$3.6x10^2$		$1.022x10^1$	
7	$11.2x10^6$	$11.2x10^6$	$3.24x10^2$	3.42x102	$1.17x10^1$	1.09x101
8	$10.1x10^6$		$2.07x10^2$		$1.02x10^1$	
8	$9.82x10^6$	9.96x106	$2.13x10^2$	2.1x102	$1.07x10^1$	1.05x101

The highest cfu/ml of microorganisms obtained was from sample E with average cfu/ml of $11.2x10^6$, $4.05x10^2$ and $1.56x10^1$ for 10^2, 10^5 and 10^7 plates respectively. However the least value obtained was from sample D with average cfu/ml of $6.16x10^3$, $1.56x10^2$ and $1.13x10^1$ for 10^2, 10^5 and 10^7 plates respectively. This result could be linked directly to moisture content of each sample as moisture play a major role in the growth and abundance of microorganisms as samples with low moisture content tends to have lower microbial load when compared to samples with higher moisture content.

VIII. SUMMARY

The study evaluated the effect of dried catfish as fortificant to both ripe and unripe plantain flour and examined the overall acceptability of Amala that was produced from the flour mixture. Specifically, the study determined the amino acid content and cholesterol level of plantain and dried catfish and the chemical, physical, microbial and sensory qualities of flour produced from plantain flour and the blend mixture. Freshly harvested unripe plantains were obtained in a farm in Oba, Ogun State and fresh catfish from Modupe Fish Farm in Lagos.

Data were analyzed using Descriptive such as mean and standard error. In addition, one-way analysis of Variance (ANOVA) otherwise known as Completely Randomized Design (CRD) was used to test if there is significant difference in the treatments for each of the parameters at 5% level of significance. Hence, the statistical package that aid in analyzing the data was Statistical Package for Social Science (SPSS 20).

The result of the analysis of variance (ANOVA) conducted for the proximate composition showed that there was a significant difference in the treatments measured for each of the parameters considered in this study (i.e. $P < 0.05$). This leads to the rejection of the null hypothesis that treatments for each of the parameters studied are the same and a conclusion was made that on average the treatment for each of the parameters (moisture, protein, lipid, ash, crude fibre, and carbohydrates) are significantly different from each other. As expected, the ash, protein, fat and crude fibre increased as the percentage of catfish plantain flour increases, while moisture and carbohydrate increased with increase in plantain flour substitutions.

The result of the analysis of variance (ANOVA) conducted for the proximate analysis showed that there was a significant difference in the treatments measured for each of the parameters considered in this study (i.e. $P < 0.05$). This leads to the rejection of the null hypothesis that treatments for each of the parameters studied are the same and a conclusion were made that on average the treatment for each of the parameters (colour, taste, flavor, texture, consistency and overall acceptability) are significantly different from each other.

IX. CONCLUSION

Conclusively, increased substitution of plantain flour with dried catfish considerably enhanced the protein, fat, ash and the dietary fibre contents of the composite flour, which could be nutritionally advantageous to Nigerians, especially the low-income earners who can hardly afford foods rich in protein because of the costs. The inclusion of catfish is a good protein, minerals and vitamins supplement for plantain flour and a naturally gluten-free alternative to wheat flour. This composite flour could therefore have good potentials in food formulation. It is recommended that Future research work could also study the effect of other less protein sources instead of catfish which may not be at the reach of the many especially the poor households who may not be able to afford it. Furthermore, efforts should be made to study different perforations that could possibly improve the storage of the flour. Research may further be extended to other types or crop aside plantain most especially cassava which is common and almost affordable by the majority.

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