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Nutritional analysis and sensory properties of pudding produced from two plantain varieties, French plantain (*Platano hembra*) and French horn Plantian (*Banana blanche*) in Michael Okpara University of agriculture, Umudike

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Abstract

The study investigated the production of Plantain pudding using two plantain varieties French plantain (*Plátano Hembra*) and French horn plantain (*Banane blanche*). It also evaluated the Proximate, Mineral, Vitamin compositions and Sensory properties of the products. Healthy cultivar of the two plantain varieties were obtained from Umudike market, Abia State. Plantain fruits were cut into smaller sizes and dried, The samples were evaluated for Proximate Analysis (Moisture, Ash, Crude Fat, Crude Protein, Crude Fibre and Carbohydrates), Mineral Analysis (Sodium, Potassium, Calcium, Zinc, Iron, Magnesium and Phosphorus) using standard methods. Sensory Attributes were also evaluated (by reconstituting the flour to make pudding using a nine point hedonic scale. All results obtained were subjected to appropriate statistical analysis. The proximate analysis carried out indicated that the composite plantain varieties could serve as a source of carbohydrate to Nigerian populace which will help in dealing with problem of malnutrition especially by supplying the nutrients needed with readily or locally available material at minimum cost. Mineral analysis indicates that pudding product of plantain can serve as a good source of Calcium. The products were also rich in Vitamin A and Vitamin C. The sensory attributes were evaluated in terms of Colour, mouth feel Taste, Texture, flavor, Aroma and surface feel and all samples were generally accepted.

Keywords: Plantain, pudding, nutrients, sensory attributes

Introduction

Plantains are rich sources of carbohydrates, minerals and vitamins. There are different varieties of the plantain; among them are the French plantain and French horn plantain. They are rich source of carbohydrates (with about 30mg/100 cal.), dietary minerals such as iron (24mg/kg), potassium (9.5/mg/kg), calcium (7.15mg/kg); vitamins such as vitamin A, Ascorbic acid, thiamine, riboflavin & niacin; and crude proteins are found (FDA Extension Bulletin on Plantain and Banana Development 2005) [2]. Plantain's sodium content is 351mg/kg; this is considered low in dietary terms hence it is frequently recommended for low sodium diet. Plantain is highly valuable in the management of diabetes, tonsillitis and stomach ulcer. The peels of plantain fruits, stalks and leaves serves as livestock feeds for small ruminants in (backyard sheep/goats keepings). Plantain has attractive export potentials in the international market and a wide local market that is largely unsatisfied. The crop also lends itself to a number of industrial uses such as in the pharmaceutical and food industries. The whole or composite flour are used as base for syrup preparation, it serves a suitable ingredient in preparation of baby food. The fruits are also employed as raw materials for production of liquor and non-alcoholic wines. The peels of the fruits can be processed into local cosmetic soaps such as Ose dudu. The stems of plantain are good source of fibres for industrial ropes, fancy hats, mat and other decorative items.

Plantains are classified formally as *Musa acuminata* or *Musa balbisiana* depending on their genomic constitution. Most plantains come from the hybrid AAB and ABB Cultivar Groups.

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There are different plantain varieties; French Plantain cultivars are called *Plátano Hembra* in Africa; examples of cultivars: Agbagda (Nigeria), Nendran (India), Dominico (Colombia). False Horn varieties (*Banane blanche*) are very common in Africa; examples of French horn types: Batard (Cameroon), Mbang Okon and Orishele (Nigeria). False horn types are consumed in Nigeria and other west african countries as well as in South America, examples are; Obino Ewai (Nigeria), Dominico-Harton (Colombia). Horn types are called *Plátano Macho* in Central America. Examples of cultivars: Ishitim (Nigeria), Pisang Tandok (Malaysia) (FDA Extension Bulletin on Plantain and Banana Development 2005) [2].

According to Baiyeri and Ajayi (2000) [1], plantain is a starchy food consumed by about 70 million people in different parts of the world in different ways. It can be fried, baked, boiled, roasted; eaten alone or with other food like rice, beans, pap and so on. Plantain is considered a delicacy which is well accepted and enjoyed by many at meal time, including children and adults. According to Rasheed (2003) [8], plantains are not only most economic source of dietary energy in terms of cost per area cultivated or weight harvested but also a useful source of carotene, vitamin A, Potassium and Iron which are essential for healthy living. Plantain flour is used excellently in bakery industries following the ban on wheat importation by Federal Government of Nigeria (Madu, 2009) [4]. Plantain is an excellent food for young children and elderly people due to its easy digestibility and nutrient content. He further pointed out that plantain has a lot of medicinal values. It is used in treatment of ulcer, diarrhea, throat infection, asthma, low libido in men. Pectin (Fibre in plantain) has been found effective in treatment of colon cancer (Ogazi, 2006) [6]. Plantain flour is a medically recommended diet for diabetic patients.

Nutritional analysis of foods allows the nutritional composition of a food product to be scientifically determined and measured. This is important as the nutritional composition of food is of major significance to the consumer and to authorities. A wide range of nutritional composition can be analysed such as; fats - including analysis for saturated, monounsaturated, polyunsaturated, trans fats, omega 3 and 6, proteins, carbohydrates - including sugars, starch, inulin, polysaccharides and polyols, mineral matter and ash, dietary fibre - by the AOAC method, salt, minerals, trace metals and other trace elements, vitamin, antioxidants, additives - including preservatives, antioxidants, sweeteners, colours, emulsifiers and stabilisers and gelling agents and organic acids - lactic, citric, malic, etc. Studies on nutritional composition of plantain suggest that plantain fruit is composed of 75 per cent liquid of different elements and 32 per cent of carbohydrates, it contains several vitamins including A, B, C and is very low in protein and fat but rich in minerals particularly iron. Also, it is free from cholesterol, high in fibre and low in sodium. Ripe plantain flour has been used in making bread, biscuits and instant flour (Ngalani and Crouzet, 2005) [5].

Sensory analysis of food is the examination of food and food products with the human senses in order to determine the organoleptic properties of the product, and the enjoyment of the products. Sensory science is the study of the reactions of the five senses; these are sight, hearing, smell, taste and touch. It helps to know the characteristics of physical matter. The "machines" are the human senses: tongue and oral cavity, nose, skin touch, eye and ears. It is necessary for the food

industry to measure the flavor, texture and other sensory characteristics of food and consumer products for quality assurance, product development and optimization, studies of alternative processing, packaging and storage, as well as relating sensory to physical properties. The aim is to determine the food quality characteristics and the degree of compliance with the legal requirements and consumer habits. Sensory attributes of foods include: appearance, flavor, taste, aroma texture/mouthfeel etc. Ihekoronye and Ngoddy (2005) [3] reported that fermentation may impart new colour, flavour, taste, and texture to food products, as well as enhancing the nutritive value and extending the shelf-life of the fermented products.

Purpose of the study: The major purpose of the study is to determine the nutritional and sensory properties of pudding produced from two plantain (*Musa paradisiaca*) varieties; french (*Plátano Hembra*) and French horn (*Banane blanche*). Specific objectives include:

- To identify the potential of french (*Plátano Hembra*) and French horn (*Banane blanche*) for pudding production.
- To determine the nutritional advantages of utilizing either french (*Plátano Hembra*) and French horn (*Banane blanche*) for pudding production.
- To compare the sensory quality of pudding produced from french (*Plátano Hembra*) and French horn (*Banane blanche*).

Research Questions: The study will seek to provide answers to the following questions:

1. How can French (Platano hembra) and French horn (Banane blanche) be used in the production of pudding?
2. What is the proximate composition of puddings produced from plantain?
3. What are the mineral compositions of the puddings?
4. What are the vitamin compositions of the puddings?
5. What is the sensory analysis of puddings produced from plantain?

Material and Method

Design of the study: The design of this study was experimental survey design because it was highly controlled and often conducted in a special setting.

Area of the study: The study was conducted in Abia State. Abia State is one of the states in the South East geopolitical zone of Nigeria. There are 17 Local Government Areas in the State. These Local Government Areas are similar in many respects as they share common boundaries. They are principally Igbo speaking, and highly populated. The inhabitants are mainly artisans, traders, teachers, civil servants, bankers, and doctors. This study will concentrate on Ikwuano L.G.A. Ikwuano Local Government Area (LGA) which is located in the western part of Abia State, has its headquarter in Isiala Oboro. It was among the new local government created on 27th, August 1991 from the old Imo State. It was carved out of the old Ikwuano-Umuahia Local Government Area. It is made up of 52 villages and is bounded by Ini LGA of Akwa Ibom State by the west and Umuahia North by the north.

Pudding is a common delicacy in Ikwuano LGA and is mostly prepared using beans as raw material. The availability of plantain in the area means that the use of plantain in the preparation of pudding will be a viable option.

Population of the Study

The sensory evaluation and analysis of the products was carried out in the Food Laboratory of Department of Home Science and Hospitality Management of MOUAU. Thirty semi trained panelist were used for the evaluation comprising of staff and students of the Department. The panelists evaluated the samples using a nine point hedonic scale.

Sample/ Sampling Technique

Panel sampling technique was used to select the thirty semi trained panelists that accessed the sensory evaluation and analysis of the puddings.

Instrument of Data Collection

Healthy Local cultivars (Agbagba) and (Orishele) of plantain (*Musa paradisiaca*) was bought from Umudike market, Abia State and was identified Mr. Okoronkwo Justice of National Root Crop Research Institute, Umudike, Abia State. The samples was prepared according to the procedure of Senayit and Tiruset (2004). A composite sample of healthy, clean fingers at matured stage was prepared for each variety.

Preparation of Plantain Flour

- 1. Washing:** Washing was done under running tap water to remove surface dirt and to reduce the surface microbial load. It also removed residual fungicides, insecticides and other pesticides that were present on the surface of the plantains.
- 2. Weighing of the plantains:** This was done to determine the flour yield from the plantains.
- 3. Slicing:** To increase surface area for drying, the plantains were sliced into 5mm thickness.
- 4. Oven drying:** Done at 80°C for 24hours
- 5. Milling:** The plantains were then being reduced into flour fineness through a milling process.

The ready plantain flour was packaged in labeled Kraft paper and stored in a cool dry place

Preparation of Plantain Pudding

The Plantain flour was poured into a bowl; small quantity of water was added and mixed till it becomes consistent. The overripe plantain was peeled and cut into small pieces. Crayfish, onions and pepper were prepared for use. The overripe plantain pieces, plantain flour batter, onions, crayfish, pepper and stock cube was blended with just enough water to allow the blades of the blender move. The smooth blend was poured into a sizeable bowl. Salt and palm oil was added and mixed thoroughly till well mixed. A small quantity of water was set in a pot to boil. When the water boiled, a base for the Plantain Pudding wraps was placed into the pot. These were leaf stalks from the uma leaves. The mixture was scooped into folded uma leaves, just as with beans pudding. The wraps were gently placed in the pot of boiling water and cook for 20-25 minutes.

Data Collection Technique

The data was collected using hedonic rating scale. Each of the

samples was rated for Colour, aroma, surface feel, taste, mouthfeel, texture and the general acceptability of the puddings.

Data Analysis Techniques

The ANOVA, Least significant difference and likert analysis was used to test for the differences among the samples. It was used to analyse the level of acceptability of pudding using the hedonic scale of 9 points:

1. Extremely dislikes
2. Dislike very much
3. Moderate dislike
4. Slightly dislike
5. Neither dislikes nor like
6. Slightly like
7. Moderately like
8. Very much like
9. Extremely like

Results and Discussions

Research question 1: How can French (Platano hembra) and French horn (Banane blanche) be used in the production of pudding?

Plantain pudding produced from the two varieties *Platano hembra* and *Banane blanche* are shown in plate 1 and 2.



Plate 1: Pudding product of *Platano hembra*



Plate 2: Pudding product of *Banane blanche*

Research question 2: What is the proximate composition of puddings produced from plantain?

Proximate Composition

Table 1: Proximate Composition of pudding produced from *Platano hembra* and *Banane blanche*

Sample	Moisture(%)	Ash(%)	Fibre(%)	Fat(%)	Protein(%)	Carbohydrate(%)
F	75.74%±0.435 ^a	0.377%±0.025	0.097%±0.025	0.146%±0.151	1.257%±0.117 ^c	22.503%±0.592 ^b
FH	78.213%±1.170 ^a	0.427%±0.211	0.067%±0.042	0.077%±0.047	1.813%±0.276 ^c	19.403%±1.589 ^b

Values are Mean ± Standard Deviation of triplicates

Values in the same column with the same superscript are significantly different

F – French Variety (*Platano hembra*)

FH – French Horn Variety (*Banane blanche*)

The proximate composition of the Plantain pudding produced from the two plantain varieties are shown in Table 1. The mean moisture content of *Platano hembra* pudding was 75.74% while that of *Banane blanche* was 78.213%. There is significant difference ($P < 0.05$) in mean moisture content between pudding products prepared from the two plantain varieties. Ash content determines the level of mineral element present in the pudding. The mean ash content of *Platano hembra* was 0.377% while that of *Banane blanche* was 0.427%, there is no significant difference ($P < 0.05$) between samples. The ash content of a food material could be used as an index of mineral constituents of the food (Sanni *et al*, 2008) [9]. Result further showed that there is no significant difference ($P < 0.05$) in crude fat between the samples. The mean crude fat content of *Platano hembra* was 0.146% while that of *Banane blanche* was 0.077%. However, plantains have

not been reported to be a good source of fat (Ojo, 2014). The crude fibre is the organic residue of vegetable origin. There is no significant difference ($P > 0.05$) among the samples. The mean crude fibre content of *Platano hembra* was 0.097% while that of *Banane blanche* is 0.067%. The mean protein content of pudding produced from *Platano hembra* was 1.257%. There was a significant difference ($P < 0.05$) in the mean protein

Platano hembra has the highest amount of carbohydrate. This could be a desirable attribute for weight watchers and diabetic patients who require less carbon. Analysis of variance showed significant difference ($P < 0.05$) in mean carbohydrate content between the two plantain varieties.

Research question 3: What are the mineral compositions of the puddings?

Table 2: Mineral Content of pudding produced with *Platano hembra* and *Banane blanche*

Sample	Ca(mg)	Na(mg)	Zn(mg)	Fe(mg)	K(mg)	P(mg)	Mg(mg)
F	40.517±8.498	20.387±5.044	0.497±0.371	1.833±0.174	72.093±8.877	35.640±4.348	49.713±2.141
FH	36.607±4.148	18.273±2.571	0.553±0.080	1.610±0.030	71.677±2.744	35.050±3.670	39.713±2.127

Values are Mean ± Standard Deviation of triplicates

Values in the same column with the same superscript are significantly different

F – French Variety (*Platano hembra*)

FH – French Horn

Variety (*Banane blanche*)

The result of the mineral analysis of Plantain pudding is shown in Table 2. The mean Calcium content of the pudding products were 40.517mg and 36.607mg for *Platano hembra* and *Banane blanche* respectively, there is no significant difference ($P > 0.05$) between the varieties. The mean sodium content of the pudding produced with *Platano hembra* was 20.387mg while that of *Banane blanche* was 18.273mg, there is no significant difference ($P > 0.05$) between the varieties. The amount of sodium is below the RDA requirement and could be recommended for hypertensive patients. The result for Zinc showed that the mean Zinc content of the pudding products were 0.497mg and 0.553mg for *Platano hembra* and *Banane blanche* respectively. There is no significant

difference ($P > 0.05$) between the zinc content of the pudding products.

The result for Iron ranges from 1.61% to 1.98%. There is no significant difference ($P > 0.05$) between the varieties. The result further shows the value for Potassium ranges from 65.10% to 82.08%. There are significant difference ($P > 0.05$) between the varieties.

Research Question 4: What are the vitamin compositions of the puddings?

Vitamin Composition

Table 3: Vitamin Content of pudding produced from *Platano hembra* and *Banane blanche*

Sample	Naicin	Vitamin A	Riboflavin	Thiamin	Vitamin C
F	0.633±0.040	63.000±4.000	0.0567±0.012	0.053±0.006	18.1667±0.321
FH	0.613±0.025	60.000±3.000	0.0433±0.015	0.050±0.010	17.523±0.464

Values are Mean ± Standard Deviation of triplicates

Values in the same column with the same superscript are significantly different

F – French Variety (*Platano hembra*)

FH – French Horn Variety (*Banane blanche*)

The mean vitamin composition as revealed by the results showed that naicin varied between 0.633mg and 0.613mg for *Platano hembra* and *Banane blanche* respectively. The result revealed that, pudding produced from *platano hembra* had the highest naicin content. However, these differences were not significant ($P > 0.05$). The mean concentration of vitamin A in the pudding was 63.00mg and 60.00mg for *Platano hembra* and *Banane blanche* respectively. Result further showed that there was no significant difference ($P < 0.05$) in thiamin

content between the two plantain varieties. The mean Vitamin C content for *Platano hembra* was 18.1667 while that of *Banane blanche* was 17.523mg.

Research question 5: What is the sensory analysis of puddings produced from plantain?

Sensory Quality of Plantain Pudding

Table 4: Sensory Quality of Pudding produced from *Platano hembra* and *Banane blanche*

Sample	Colour	Aroma	Surface feel	Taste	Mouthfeel	Texture	Overall acceptability
F	5.57	6.17	6.07	6.19	5.47	5.43	5.82
FH	6.30	6.04	5.67	5.47	5.57	6.35	5.9

Values are Mean \pm Standard Deviation of triplicates

Values in the same column with the same superscript are significantly different

F – French Variety (*Platano hembra*)

FH – French Horn Variety (*Banane blanche*)

The result for the sensory evaluation of the plantain pudding was shown in Table 4. There were no significant difference ($P>0.05$) in almost all the sensory attributes evaluated in all the samples. Colour is an important quality of many foods and it influences the sense of judgment of consumers. Colour plays an important role in food because consumers are sometimes moved by what they see. The result of the colour obtained showed that there was no significant difference ($P>0.05$) between the plantain varieties. Taste is also a very important quality attribute of food. The result showed that there was no significant difference ($P>0.05$) in the samples. Texture is another quality attribute of food; it was characterized by smoothness, coarseness, grittiness etc. there were no significant difference ($P>0.05$) between the varieties. The Aroma is an important parameter of food. Result shows there are no significant difference among the samples.

The result for the mouthfeel shows there are no significant difference ($P>0.05$) between the varieties. The result for overall acceptability showed that there was no significant difference ($P>0.05$) in the varieties. All samples were liked moderately.

Conclusion

This study examined the nutrient and sensory properties of plantain pudding produced from two plantain (*Musa paradisiaca*) varieties french (*Plátano Hembra*) and French horn (*Banane blanche*). The proximate analysis carried out indicated that the composite plantain varieties could serve as a source of carbohydrate to Nigerian populace which will help in dealing with problem of malnutrition especially by supplying the nutrients needed with readily or locally available material at minimum cost. In other words, the two varieties of plantain contained appreciable amount of nutrients and can help in dealing with problem of malnutrition.

Mineral analysis indicated that pudding product of plantain can serve as a good source of Calcium. The products were also rich in Vitamin A and Vitamin C.

The sensory evaluation showed that all the samples were liked very much. There were no significant differences ($P>0.05$) for all the samples in terms of Colour, taste, texture, flavor, and overall acceptability. This was an indication that the sensory attributes of the food has impact on the consumers' acceptability of the pudding.

The study has shown that the two varieties of plantain contained appreciable amount of nutrients and can help in dealing with problem of malnutrition.

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