THE UTILIZATION OF WHOLE UNRIPE PLANTAIN FOR PRODUCTION OF AMALA AND CHIPS SNACK

BY

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ND/23/HMT/PT/0024

BEING A RESEARCH PROJECT SUBMITTED TO

THE DEPARTMENT OF HOSPITALITY MANAGEMENT TECHNOLOGY,
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KWARA STATE POLYTECHINC,
ILORIN

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF NATIONAL DIPLOMA (ND) IN HOSPITALITY MANAGEMENT TECHNOLOGY

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CERTIFICATION

This is to certify that this research project work is successfully carried out by SANNI KHADIJAT ABIODUN with Matric number: ND/23/HMT/PT/0024 in the Department of Hospitality Management Technology, Institute of Applied Sciences (IAS), Kwara State Polytechnic, Ilorin. In partial fulfillment of the requirement for the award of National Diploma (ND) in Hospitality Management Technology.

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DEDICATION

I dedicate this project to Almighty Allah, Father in heaven, the author and finisher of my faith. Also to my lovely parents Mr. & Mrs. Sanni for their moral and financial support, May the lord reward you (Amen).

ACKNOWLEDGEMENTS

First and foremost, I thank God Almighty for sparing my life to this moment and through my education period and for bestowing on my grace, good health, indefatigable knowledge with which I started and completed my ND programme. To his effect therefore, I say many glory, honor; praise, adorations, majesty, and thanksgiving be ascribed to the Almighty God.

I acknowledge the effect of my beloved and able parents in person of Mr. & Mrs. Sanni for their support both morally and financially.

My gratitude goes to my able supervisor in person of Mrs. Hassan Q.O. and my able project coordinator Mrs. Adebayo S.M., My gratitude goes to my able [HOD] Mrs. Aremu O.O. and all the entire staff in the department of Hospitality Management whose knowledge I have been brought to this level may God bless you and reward you

I also appreciate all my friends and my loved ones who make the institution be likely and worthwhile and all the BFF'S Taibat, Rachael and my entire classmates, May God bless you all (Amen).

ABSTRACT

This study investigated the utilization of whole unripe plantain (Musa paradisiaca) in the production of amala *and chips snack as a strategy for promoting food diversification and reducing post-harvest losses. Unripe plantain, known for its high resistant starch, dietary fiber, and low sugar content, was processed into flour for* amala *and sliced into chips for deep frying. The nutritional composition, functional properties, and sensory attributes of the developed products were evaluated. The analysis revealed that* amala *and chips produced from unripe plantain retained significant amounts of essential nutrients such as potassium, dietary fiber, and iron. Sensory evaluation showed that both products were generally acceptable in terms of taste, texture, color, and overall acceptability, with slight preference variations based on consumer familiarity and preference. The findings suggest that whole unripe plantain can serve as a valuable raw material for creating nutritious and appealing traditional and modern food products. This approach supports local food sustainability, value addition, and improved dietary diversity in plantain-consuming regions.*

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CHAPTER ONE

INTRODUCTION

1.0 Background of the Study

Plantain flour is a powder traditionally made of green plantains. Historically, plantain flour has been used in Africa and Jamaica as a cheaper alternative to wheat flour. (Coghalan, Lea.“Business goes plantains” queen island contrufy life May 13th, 2022). It is now often used as a gluten free replacement to wheat flours (Gray, Nathna, Pasta goes plantain Green plantain flour offers gluten free pasta solutions. (Food Navigator.com, 2022). Or as a source of resistant starch, which has been promoted by certain dieting trends such as paleo and primal diets and by some recent nutritional research. (Langkilde, Anna Maria, et al., 2022). Effect of high resistant starch plantain flour (RS2) on in vitro fermentation and small bowel excretion of energy, nutrients and serols, an ilestormy study”. American Journal of Clinical Nutrition.

Plantain flour, due to the use of green plantains has a very mild plantain flavor raw and when cooked, it has an earthy non-plantain flavor; it also has a texture reminiscent of lighter wheat flours and requires about 25% less volume, making it a good replacement for white and white whole wheat flour. This has led to rising popularity among those suffering from Celias disease and gluten free eaters.

Plantain flour is generally produced, with green plantains that are peeled, chopped, dried and then ground. (Ovando- Martinz, Maribel et al., 2022). Unripe plantain flour as an ingredient to increase the indigestible carbohydrates of pasta.

This process can be completed traditionally by hand where plantains are sun dried, dried in an oven, or residential food dryer and then either ground in a mortar and pestle or with a mechanical grinder. The green plantain process requires 10kg of raw green plantains to produce 1kg of plantain flour.

In recent years, large scale commercial production has begun in Africa and South America using the same basic methodology. Chile has been developing an alternative method of plantain flour production using ripe plantain waste. Chilean researchers have developed a process that uses over ripe plantain peels to add dietary fiber to the ripe plantain fruit, which does not have resistant starch properties of green plantains.

While lacking resistant starch, there are clear advantages over plantain powder. Plantain powder is made from dried and ground fully ripened plantain puree and thus does not have the fiber of plantain peel flour content nor the resistant starch, of green plantain flour

Plantain powder is typically used as additives for baby food and smoothies for large amounts of potassium and other nutrients contained in plantains without the starchy properties of green plantain flour.

Academic and institutional researchers in a number of countries have been conducting studies on the effect of plantain flour on human health. There has been such strong interest in plantain flour recently because of its high resistant starch content. The study by Thai researchers found that green plantains have the largest percentage of resistant starch, along with legumes and glass noodle product, out of numerous possible sources tested.

In March, 2021, Lowa State University held an international symposium on the health benefits of resistant starch. Researchers from around the World come together to discuss their various research, including that resistant starch reduces that risk of colon cancer, obesity and diabetes. It is these benefits that have had many medical professional suggest that the resistant starch content of current food products should be increased in order to combat these rising societal problem. In particulars, Maribel Ovando-Martinez led a group of researcher from Mexico and Spain did a study in order to find what effect the addition of plantain flour to pasta would have on pasta's resistant starch context. Their results showed that such an addition to a normal pasta recipe even with cooking loss appreciably increased the resistant starch content of the pasta (Ovando-Martinez, Maribel et al., 2020 Unripe plantain flour as an ingredients to increase the undigestible carbohydrates of pasta).

Plantain (MUSA AAB) is a major source of carbohydrate in diets of people from Latin America through most of Africa and countries in South East Asia (Marriott and Lancoister, 2021). It is estimated that 60 million people in West Africa derive more than 25% of their carbohydrate intake from plantain (Ortiz and

Vuylsteiice, 2022). Plantain is believed to have originated in Coastal West Africa presumably in Guinea or Sierra Leone and was adopted in the New World for the sweet form with yellow skin (peel) of the product.

The word plantain is now widely used to refer to the starchy cooking plantains, which often have green or red skins. Plantain presumably originated from the Spanish word “Plantano”. It is grown nearly in 130 counties with Uganda being the largest producer in the sub Sahara Africa (SSA) followed by Rwanda, Ghana, Nigeria and Cameroon.

Several varieties of plantain are cultivated in West Africa. These are classified as Plantain, and Ornamental with each classes having their sub varieties. The local names of the sub varieties varies from country to country pest and diseases have effect on the production of these native varieties, the most notable being the “fungal disease, black Sigatoka (Mycosphaerella figiensis) (Stover and Diamonds, 2018, Swennen, 2019).

Yield losses due to the disease are highly significant ranging from 20 to 50%. Under very severe condition yield losses as high as 80% (Hemeng and Banful, 2018).

In view of this, new hybrids were introduced from Honduras in 2007 to supplement the land races. The tetera phoid hybrids are high yielding and disease tolerant. They are produced when female fertile triploid land races of plantain (AAB Genomes) are crossed to diploid accession of M. acuminate or M. Balbiisiana that are resistant to black sigatika disease.

Plantain is however a seasonal and highly perishable crop. Ogazi (2018) reported that over 80% of the crop is harvested during the period of September to February, and that there is much wastage during this period as some of the products do not store for a long period. This results in seasonal unavailability and limitations on the used by urban populations. Therefore, there is need to develop preservation methods for this crop.

Functional property has been defined by Mati, (2021) as those characteristics that govern the behavior of nutrients in food during processing, storage and preparation as they affect food quality and acceptability. Some of the important functional properties that influences the utility of most starchy staples such as plantain include the drying characteristics, water binding capacity, swelling power, solubility, emulsion capacity, oil abruption capacity, whip ability foam stability and viscosity.

Plantain plants are monocotyledonous perennial and important crops in the tropical and subtropical world regions (Strosse et al., 2021). They include dessert plantain, plantain and cooking plantains. Traded plantain (Musa paradisiaca AAB) and other cooking plantains (Musa ABB) are almost entirely derived from the AA·BB hybridization of M. acuminata (AA) and M. balbisiana (BB) (Stover and Simmonds 2020; Robinson 2019). Plantain and cooking plantains are very similar to unripe dessert plantains (M. Cavendish AAA) in exterior appearance, although often larger; the main differences in the former being that their flesh is starchy rather than sweet,

they are used unripe and require cooking (Happi Emaga et al., 2022). Dessert plantains are consumed usually as ripe fruits; whereas ripe and unripe plantain fruits are usually consumed boiled or fried (Surga et al., 2020).

Plantain plantations constitute extensive crops in tropical and Caribbean countries, where they are used as basic food. In Venezuela, the commercial plantain cultivar used is the Harton variety. It is difficult to establish the production volumes, as the areas where it is grown are dispersed over the country, either in artesanian familiar small areas (conucos) or in large areas where it is produced for export. The production of plantain in Venezuela during the ten last years, excluding dessert plantain fruits (cambur), has been estimated at 5850000ton (FAO, 2020; Agrevo, 2018; MAT, 2018).

New high yield cultivars allow plantain plants to be grown more extensively, resulting in a higher economic value, as they respond to plant improvement methods, fertilization and pest and disease control (Gwanfogbe et al., 1988). From the nutritional point of view, these fruits are among the green vegetables with the richest iron and other nutrients contents (Aremu and Udoessien, 1990). However, they are highly perishable and subjected to fast deterioration, as their moisture content and high metabolic activity persist after harvest (Demirel and Turhan, 2003). Air-drying alone or together with sun-drying is largely used for preserving unripe plantain. Besides helping preservation, drying adds value to plantain. Plantain chip is one such value-added product with a crispy and unique taste, consumed as a snack and as an

ingredient of breakfast cereals. It can be consumed as produced or further processed by coating with sweeteners, frying, dehydrating or boiling (Demirel and Turhan, 2003). Plantain powder is prepared from dessert plantains after mashing and drying the pulp in drum or spray dryers. The dried product is pulverized and passed through a 100-mesh sieve, producing a free-flowing powder which is stable for at least one year after packaging. This powder is used in bakery and confectionery industries, in the treatment of intestinal disorders and in infant diets (Adeniji et al., 2022).

Though drying has been widely used to promote food preservation as the reduction of moisture context brings down microbial activity and extends product life one must consider the other charges that accompany drying, even more so in the case of cellular materials, which may be greatly affected by the dehydration process.

1.2 Statement of the Problems

Snacks such as meat pie and sausage roll that are prepared from wheat flour are stable food consumed worldwide. Research into production of snacks and other bakery products from non-wheat raw materials is gaining momentum in particular because of people with gluten intolerance and also to locally available crops rich such as rice, sweet potatoes, wateryam flour and millet pancakes for baked products rich in nutrients and antioxidants. Precisely, cereals, legumes and tubers are being utilized for the production of composite flours which have advantages of being rich in protein, fibre and antioxidants (Awolu et al., 2017).

Nutritionally rich and health-promoting cookies have been produced from composite flours sourced from rice, sweet potato, water yam and millet (Awolu et al., 2017).

Furthermore, Snacks made from unripe plantain flour may have a different texture compared to those made from traditional flours. Achieving a desirable texture and palatability that appeals to consumers can be difficult, especially when dealing with the inherent properties of unripe plantain flour, such as its density and potential for a slightly bitter taste. Unripe plantain flour-based snacks may have different shelf life and preservation requirements compared to those made from conventional flours.

1.3 Aim and Objectives of the Study

1.3.1 General Objectives

The general objective of the study is the utilization of unripe plantain flour for the production of Amala & Chips Snacks.

1.3.2 Specific Objectives

In the course of this research work, the following specific objectives are being brought up:

- To examine the general acceptability of snacks produced from unripe plantain flour
- To use unripe plantain flour to produce Snacks.
- To examine the health and nutritional benefits of unripe plantain.

1.4 Research Questions

- What are the general acceptability of snacks produced from unripe plantain flour?
- How can unripe plantain flour be used to produce Snacks?
- What are the health and nutritional benefits of unripe plantain?

1.5 Significance of the Study

The study will be of significance to the hospitality industry as a whole as it will showcase how unripe plantain flour can be used as a substitute for the common wheat flour . Also the essential nutrients of plantain as a whole which includes protein, healthy fats, vitamins (e.g., B vitamins, vitamin E), and minerals (e.g., magnesium, phosphorus) will be analyze in the snacks production which can highlight these nutritional benefits.

Finally, this research will enable the Nigerian government to invest more in the cultivation and storage of plantain in order to enhance optimal utilization of its numerous health importance.

1.6 Scope of the Study

The scope of the study is the utilization of unripe plantain flour for the production of snacks (meat-pie and sausage roll). Furthermore, the health and the nutritional benefits will be analzed.

Limitations and Constraints To The Study

In caring out this research project, the researcher encounters the following inhibitions:

i. Financial Constraint: Insufficient fund tends to impede the efficiency of the researcher in sourcing for the relevant materials, literature or information and in the process of data collection (internet, questionnaire and interview).

ii. Time Constraint: The researcher will simultaneously engage in this study with other academic work. This consequently will cut down on the time devoted for the research work.

1.7 Definitions of Terms

- **Unripe Plantain Flour**: A type of flour made from unripe green plantains, which are sliced, dried, and ground into a fine powder. It is high in resistant starch, dietary fiber, and essential nutrients like potassium, vitamins A and C.
- **Utilization:** Utilization is the primary technique wherein success and performance efficiency are determined. This is especially in the case with tools and equipment.
- **Flour**: Flour is a powder made by grinding raw grains, roots, beans, nuts, or seeds. Flours are used to make many different foods. Cereal flour, particularly wheat flour, is the main ingredient of bread, which is a staple food for many cultures.

- **Snacks**: A snack is a small portion of food generally eaten between meals. A snack is often less than 200 calories, but this can vary. Snacks come in a variety of forms including packaged snack foods and other processed foods, as well as items made from fresh ingredients at home
- **Production**: Production is the process of combining various inputs, both material and immaterial in order to create output. Ideally this output will be a good or service which has value and contributes to the utility of individuals
- **Unripe**: "Unripe" can refer to something that is not yet mature or developed. Here are a few possible contexts: In a literal sense, "unripe" refers to fruit or other produce that is not yet ready to be eaten or harvested. In a figurative sense, "unripe" can describe someone or something that is immature, inexperienced, or not yet fully developed.
- **Hospitality:** Hospitality is the relationship between a guest and a host, wherein the host receives the guest with some amount of goodwill, including the reception and entertainment of guests, visitors, or strangers. ... Hospitality ethics is a discipline that studies this usage of hospitality.
- **Industry:** In macroeconomics, an industry is a branch of an economy that produces a closely-related set of raw materials, goods, or services. For example, one might refer to the wood industry or to the insurance industry. An *industry* is a group of companies that are related based on their primary business activities.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The word Plantain is thought to be of West Africa origin, possibly from the wolof word “Banaana” and passed into English via Spanish or Portuguese. The Plantain is an edible fruit botanically a berry. (Plantain from fruits of warm climates” by Julia Morton”, Hort Purdue.edu. Archieved from the original by several lands of large herbaceous flowering plants in the genus Musa.

In some countries, Plantains used for cooking may be called plantains, in contrast to dessert Plantains. The fruit is variable in size, color and firmness, but is usually elongated and curved, with soft flesh rich in starch covered with a rind which may be green, yellow, red, purple or brown when ripe. The fruits grow in clusters hanging from the top of the plant. Almost all modern edible parthenocorpie (seedless) Plantains come from two wild species MUSA ACUMINATA and MUSA BALBISIANA. The scientific names of most cultivated Plantains are Musa Acuminata, Musa balbisiana, and Musa X paradisiac for the hybrid Musa acuminata X M. balbisiana, depending on their genomic constitution. The old scientific name Musa sapientum is no longer used.

Musa species are native to tropical Indomalaya and Australia, and are likely to have been first domesticated in Papua New Guinea(ab tracing antiquity of Plantain cultivation in Papua New Guinea, 2007 and Nelson Ploet2 and Kpt 2021).

Worldwide, there is no sharp distinction between “Plantain” and “plantains” especially in the Americas and Europe; “Plantain” usually refers to soft, sweet, dessert Plantain, particularly those of the covendish group, which are the main exports from Plantain-growing countries. By contrast, Musa cultivars with firmer, starchier fruit are called “plantains”.

In other regions, such as South East Asia, many more kinds of Plantain are grown and eaten, so the simple two-fold distinction is not useful and is not made in local languages. The term “Plantain” is also used as the common name for the plants which produce the fruit

This can be extended to other member of the genus Musa like the scarlet Plantain (Musa coccinea, pink Plantain (Musa Velutina) and the Fe’I Plantains. It can also refer to members of the genus Ensete, like the snow Plantain (Ensete glaucum) and the economically important false Plantain (Ensete Ventricosum). Both genera are classified under the Plantain family musaccea. The Plantain plant is the largest herbaceous flowering plant. Montepellier International Network for the improvement of Plantain and plantain & International plant Genetic resources Institute. All the above-ground parts of Plantain plant grow from a structure usually called a corm. Plantain plants are normally tall and fairly sturdy, and are often mistaken for trees, but what appears to be a trunk is actually a “false stem” or pseudostem. Plantains grow in a wide variety of soils, as long as the soil is at least 60cm deep, has good drainage and is not compacted). Cultivated Plantain plants vary in heights depending on the variety and growing conditions. Most are around 5m (16ft) tall, with a range

from “Dwarf Cavendisn” plants at around 3m (l0ft) to “Gros Michel” at 7m (23ft) or more Leaves are spirally arranged and may grow 2.7 metres (8.9ft) long and 60cm (2.0ft) wide.

2.2 Cultivation of Plantain

Modern Cultivation

All widely cultivated Plantains today descend from the two wild Plantains Musa Acuminata and Musa Balbisiana. While the original wild Plantains contained large seeds, diploid or polyploid cultivars (some being hybrids with tiny seeds are preferred for human raw fruit consumption (Aabcd castle, Matt). The unfortunate sex life of the Plantain.

These are propagated asexually from offshoots. The plant is allowed to produce two shoots at a time a larger one for immediate fruiting and smaller “sucker or follower” to produce fruit in 6-8 months. The life of a Plantain plantation is 25 years or longer, during which time the individual stools or planting sites may move slightly from their original position as lateral rhizome formation dictates. (How Plantain are grown. Plantain link retrieved 2014).

Cultivated Plantains are parthenocarpic, i.e. the flesh of the fruit swells and ripens without its seeds, being fertilized and developing. Lacking unable seeds, propagation typically involves farmers removing and transplanting part of the under grown stem (called a corm). Usually this is done by carefully removing a sucker (a vertical shoot that develops from the base of Plantain pseudostem) with some roots intact. However, small sympodial corms, representing not yet elongated suckers, are easier to transplant and can be left out of the ground for up to two weeks.

It is not necessary to include the corm or root structure to propagate Plantains; served suckers without root materials can be propagated in damp sand, although this takes somewhat longer. As a non-seasonal crop, Plantains are available fresh year-round. In global commerce in 2009, by far the most important cultivars belongs to the triploid AAHA group of Musa acuminate, commonly referred to as covendish group Plantains. They accounted for the majority of Plantain exports, (Aabcd castle, Matt). The unfortunate sex life of the Plantain.

2.3 Plantain Ripening

Export Plantains are picked green, and ripen in special rooms upon arrival in the destination country. These rooms are air-tight and filled with ethylene gas to induce ripening. The vivid yellow color consumers normally associated with supermarket Plantain is, in fact, caused by the artificial ripening process. (Ding et al, Ahmad; S. H; Razak, A.R.A; Shaart, N and Mohammed, M. T. M. Plastid ultra structure, chlorophyll contents, and color expression during ripening of Plantain).

Flavor and texture are also affected by ripening temperature. Plantains are refrigerated to between 13.5 and 150C (56.3 and 59.00f) during transport. At lower temperatures, ripening permanently stalls, and the Plantains turn gray as cell walls break down. The skin of ripe Plantains quickly blackens in the 40C (390F) environment of a domestic refrigerator, although the fruit inside remains unaffected. (Ahmad, Saeed, Chatha, Zia Ahmad, Nasir, Muhammed Adrami; Aziz Abdul and Mohson Malik 2006). Effect of relative humidity on the ripening behavior and quality of Plantain fruit).

“Tree-ripened” Cacendish banans have a greenish-yellow as appearance which change to brownish-yellow as they ripen further. Although both flavor and texture of tree-ripped Plantains is generally regarded as superior to any type of green-picked fruits, this reduces shelf life to only 7-10 days (Are Plantains about to become extinct 2012).

Plantains can be ordered by the retailers “ungassed” i.e not treated with ethylene, and may show up at the supermarket fully green. Guineos Verdes (green Plantains) that have not been gassed will never fully ripen before becoming rotten. Instead of fresh eating, these Plantains can be used for cooking, as seen in Jamaican Cuisines (Kirschber, Chanie (January 21, 2016). 4 ways to use green Plantains that won’t ripen. Mother nature network retrieved April, 30, 2021).

A 2008 study reported that ripe Plantains fluoresce when exposed to ultraviolet light. This property is attributed to the degradation of chlorophyll leading to the accumulation of a fluorescent product in the skin of the fruit. The chlorophyll breakdown product is stabilized by a propiorate ester group. Plantain-plant leaves also fluoresce in the same way. The green Plantains do not fluoresce. The study suggested that this allows animals which can see light in the ultraviolet spectrum (tetrachromats and pentachromats) to more easily detect ripened Plantains (Moses Simona, Muller, Thomas Ebert, Marcolivier, Jockusch, Steffen; Turno, Nicholas J, and Krautter Bernhard (2008) Blue luminescence of ripening Plantains.

2.4 Importance of Plantain

Plantains and plantains constitute a major staple food crop for millions of people in developing countries. In most tropical countries, green (unripe) Plantains used for cooking represents the main cultivars. Plantains are cooked in ways that are similar to potatoes. Both can be fried, boiled, baked, or chipped and have similar taste and texture when served. One Plantain provides about the same earlier as one potato. Most producers are small-scale farmers either for home consumption or local markets. Because Plantains and plantains produce fruit year round, they provide an extremely valuable food from on annual/semi-annual harvest has been consumed, and the next is still to come).

Plantains and plantains are therefore critical to global food security. Plantains are among the most widely consumed food in the world. Plantains are staple starch for any tropical populations. Depending upon cultivar and ripeness, the flesh can vary in taste from starchy to sweet, and texture from firm to mushy. Both the skin and inner part can be eaten raw or cooked. The primary components of the aroma of fresh Plantain is “isoamylacetate” (also known as Plantain oil) when along with other compounds such as butyl, acetate and isobutyl acetate is a significant contributor to benona flavor compositional and isotope studies of fruit flavors.

Plantains are eaten deep fried, taken in their skin, in a spit bamboo, or steamed in glutinous rice wrapped in a Plantain leaf. Plantain can be made into jam.

Plantains are used for pancakes. Plantain chips are a snack produced from sliced dehydrated affected Plantain or plantain, which have a dark brown color and an intense Plantain taste. Dried Plantains are also ground to make Plantain flour. Extracting Plantain juice is difficult, because when a Plantain is compressed, it simply turns to pulp. Plantains feature prominently in Philippine, cuisne, Plantains are also commonly used in cuisine. In the South-Indian state of Kerala, where they are steamed and made into curries, fried into chips or fried in batter.

The Plantain plant has been long a source of fiber for high quality textile. In Japan, Plantain cultivation for clothing and household use dates back to at least the 13th century. In the Japanese system, leaves and shoots are cut from the plant periodically to ensure softness. Harvested shoots are first boiled in iye to prepare fibers for yarn-making. These Plantain shoots produce fibers of varying degrees of softness yielding yarns and textiles with differing qualities for specific uses. For example the outermost fiber of the shoots are the coarsest, and are suitable for table cloths, while of softest inner most fiber are desirable for kimono and kamishimo. (Traditional crafts of Japan Kiroka Plantain fiber cloth. Association of the promotion of traditional craft industries. Plantain fiber is used in the production of Plantain paper. Plantain paper is made from two different parts; the bark of the Plantain plant mainly used for artisitic purposes, or form the fibers of the stem and non-usable fruits. The paper is either hand-made or by industrial process.

2.5 Nutritional Value of Plantain

Plantains	**(Daily value)**	
Nutritional value per	100g (3.502)	
Energy	371kg (89kcal)	
Carbohydrates	22.8jk	
Sugars	12.23g	
Dietary fiber	2.6g	
Fat	0.33g	
Protein	1.09g	
Vitamins		
Thiamine (B1)	0.031mg	3%
Riboflavin (B2)	0.073mg	6%
Nacin (B3)	0.665mg	4%
Pentothenic acid (B5)	0.334mg	7%
Vitamin B6	0.4mg	(31%)
Folate (B9)	20ng	(5%)
Choline	9.8mg	(2%)
Vitamine	8.7mg	(10%)
Minerals		
Iron	0.26mg	(2%)
Magnesium	27mg	(8%)
Manganese	0.27mg	(13%)
Phosphorus	22mg	(3%)
Potassium	358mg	(8%)
Sodium	1mg	0%
Zinc	0.15mg	2%
Other constituents		
Water	74.91g	

Source: National Nutrient Database for Standard reference, released 28/11/2015.

Raw Plantains are 75% water, 23% carbohydrates, 1% protein, and contains negligible fact (table). In a 100 gram amount, Plantains supply 89 calories and are a rich source of vitamins B6, providing 31% of the daily value, and contain moderates amounts of vitamin c, manganese and dietary fiber.

2.6 Plantain Flour

Plantain flour is a powder traditionally made of green Plantains. Historically, Plantain flour has been used in Africa and Jamaica as a cheaper alternative to wheat flour. (Coghalan, Lea.“Business goes Plantains” queen island contrufy life May 13th, 2022).

It is now often used as a gluten free replacement to wheat flours (Gray, Nathna, Pasta goes Plantain Green Plantain flour offers gluten free pasta solutions. (Food Navigator. Com June 25th 2012). Or as a source of resistant starch, which has been promoted by certain dieting trends such as paleo and primal diets and by some recent nutritional research. (Langkilde, Anna maria, et al). Effect of high resistant starch Plantain flour (RS2) on in vitro fermentation and small bowel excretion of energy, nutrients and serols, an ilestormy study”. American Journal of Clinical Nutrition.

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2.7 Health Benefits of Plantain Flour

Academic and institutional researchers in a number of countries have been conducting studies on the effect of Plantain flour on human health. There has been such strong interest in Plantain flour recently because of its high resistant starch content. The study by Thai researchers found that green Plantains have the largest percentage of resistant starch, along with legumes and glass noodle product, out of numerous possible sources tested.

In March, 2014, Lowa State University held an international symposium on the health benefits of resistant starch. Researchers from around the World come together to discuss their various research, including that resistant starch reduces that risk of colon cancer, obesity and diabetes. It is these benefits that have had many medical professional suggest that the resistant starch content of current food products should be increased in order to combat these rising societal problem. In particulars, Maribel Ovando-Martinez led a group of researcher from Mexico and Spain did a study in order to find what effect the addition of Plantain flour to pasta would have on pasta's resistant starch context. Their results showed that such an addition to a normal pasta recipe even with cooking loss appreciably increased the resistant starch content of the pasta (Ovando-Martinez, Maribel et al. Unripe Plantain flour as an ingredients to increase the undigestible carbohydrates of pasta).

Other researchers did similar tests adding Plantain flour to breed and also found Plantain flour increased the total resistant starch content of the final product.

Researchers have also conducted tests on the effects of Plantain flour has on taste and general palatability. A pair of researchers found that adding 30% Plantain flour to yellow noodle recipes significantly increased the resistant starch content with almost no sensory/ palatability differences from the control group.

Plantain flour offers numerous health benefits, making it a nutritious addition to your diet. Here are some of the key advantages:

- Digestive Health: Plantain flour is high in dietary fiber, which promotes healthy digestion, prevents constipation, and supports a healthy gut microbiome.
- Heart Health: The potassium content in plantain flour helps regulate blood pressure, while the fiber helps lower cholesterol levels, reducing the risk of heart disease.
- Weight Management: The high fiber and resistant starch in plantain flour can help you feel full for longer, aiding in weight management and portion control.
- Blood Sugar Control: Plantain flour has a low glycemic index, making it suitable for individuals with diabetes or those looking to manage their blood sugar levels.
- Immune Support: Plantain flour is rich in vitamins A and C, which support immune function and overall health.
- Antioxidant Properties: Plantain flour contains antioxidants that help protect the body from oxidative stress and reduce the risk of chronic diseases.

- Bone Health: The presence of magnesium and potassium in plantain flour supports bone health and helps prevent conditions like osteoporosis.
- Anti-Inflammatory Properties: Plantain flour contains compounds with anti-inflammatory effects, which can help reduce inflammation in the body.
- Prevents Anemia: Plantain flour is a good source of iron, essential for healthy red blood cells and preventing anemia.
- Supports Healthy Gut Bacteria: The resistant starch in plantain flour promotes the growth of beneficial bacteria in the gut, supporting a healthy gut microbiome.

Overall, plantain flour is a nutritious and versatile ingredient that can be incorporated into various dishes, from baked goods to savory meals. Its gluten-free nature makes it an excellent option for those with gluten intolerance or sensitivity.

Plantain flour offers several health benefits due to its rich nutrient content and fiber. It can aid in weight management, improve digestion, and support heart health. Additionally, it's a good source of vitamins, minerals, and antioxidants, making it a nutritious alternative to other flours.

Plantain is a staple food consumed by many because of its rich health benefits. Plantain flour is made from dried green or unripe plantain slices. It is consumed as an alternative to regular flour. Plantain flour has all the health benefits found in unripe plantain intact. In fact, it is a smart way of preserving it’s rich health content, since if left alone, would ripen. Thereby having its original content converted to carbohydrate variants.

Unripe plantain flour is highly recommended not only for people with diabetes, but all who desire to maintain good health, because it is gluten free, rich in potassium, iron, magnesium, phosphorus, vitamin A and B. It is low in calories too. Here's a more detailed look at the benefits:

1. Weight Management:

- Plantain flour is high in dietary fiber, which helps you feel full and satisfied, promoting weight loss.
- It can also help lower cholesterol levels, which is beneficial for overall health.

2. Digestive Health:

- The fiber content aids in digestion and prevents constipation.
- It can also support the gut microbiota, which is important for overall health.

3. Heart Health:

- Plantain flour is rich in potassium, which helps regulate blood pressure and heart rate.
- It can also help dilate arteries and improve blood flow.

4. Nutrient-Rich:

- Plantain flour is a good source of vitamins (A, B, C), minerals (potassium, magnesium, iron, phosphorus), and antioxidants.
- It is also gluten-free, making it a suitable option for individuals with gluten intolerance.

5. Other Benefits:

- It can boost energy levels and fight inflammation.
- Some studies suggest it may improve brain health and control blood sugar levels.
- It's also believed to be good for the liver and potentially improve libido.

6. Versatility:

- Plantain flour can be used in various recipes, from baking to cooking, making it a versatile ingredient.
- It can be used as a substitute for wheat flour in a 1:1 ratio in most recipes

Nutritional Benefits

1. **High in Dietary Fiber**
    - Aids digestion and improves bowel movement.
    - Helps in maintaining satiety, which is beneficial for weight management.
2. **Low Glycemic Index (GI)**
    - Releases glucose slowly into the bloodstream, making it ideal for diabetic-friendly amala and snacks.
3. **Rich in Resistant Starch**
    - Acts as a prebiotic to support gut health.
    - Helps regulate blood sugar levels and lowers cholesterol.

4. **Rich in Vitamins & Minerals**
    - Contains vitamin A, B6, C, iron, potassium, and magnesium, which support immune function and heart health.
5. **Gluten-Free**
    - Suitable for people with gluten intolerance or celiac disease.

Health Benefits

1. **Improves Digestive Health**
    - The fiber and resistant starch help prevent constipation and promote a healthy gut microbiome.
2. **Supports Weight Management**
    - Its high fiber content promotes fullness and reduces overeating.
3. **Helps Control Blood Pressure**
    - Potassium in plantains helps balance sodium levels and reduce hypertension.
4. **Anti-inflammatory Properties**
    - Contains antioxidants and bioactive compounds that reduce inflammation in the body.
5. **Boosts Brain Function**
    - Vitamin B6 supports neurotransmitter production and cognitive function.

Processing & Functional Benefits in Amala and Snacks

1. **Improves Texture and Consistency**
    - Unripe plantain flour gives amala a smooth and elastic texture.
    - In snacks like crackers or chin-chin, it offers a crisp but tender bite.
2. **Enhances Shelf Life**
    - Its low moisture content and acidity help preserve snacks for a longer period.
3. **Natural Binding Agent**
    - Acts as a good binder in recipes without the need for additives.
4. **Neutral to Slightly Sweet Flavor**
    - Allows easy blending with other flours or ingredients (e.g., millet, oats, wheat) for improved snack variety.
5. **Economical and Locally Available**
    - Supports local agriculture and reduces production cost compared to imported flours.

Suitable for Specialized Diets

- Ideal for:
    - Low-carb diets
    - Diabetic diets
    - Weight-loss programs
    - Paleo and gluten-free diets

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the research methods that were employed in generating data for the research project. It explains the research design, the study population, sampling method and procedures, data collection procedures and instruments and finally presents the data analysis procedure.

3.2 Research Design

A field survey method approach of research design was adopted in this study. A field survey research assess situation as a prequisite to inference and generalization. A field survey method enables the researcher to successfully access field operation with regards to the use of unripe plaintain in hospitality industry and its benefit to mankind. Successful field operation must be based on soundly structured questionnaire, and well-trained interviewers. A field survey method enables the researcher to obtain the opinion of the representative sample of the targeted population in order to find the perception of the entire population on how unripe plantain consumption has positively enhance their health status.

3.3 Study Area

The study area of the study is Hospitality Management Department which consists of the staff and students.

3.4 Target Population of the Study

Population "as the means of identifying characteristic which number of the universe have in common and which will identify each unit being a member of a particular group. The population for the study will be Thirty (30).

3.5 Sampling Techniques

The techniques for research in this study, shall be carried out in specific area of sample study to cover the particular area of the population on the basis of questionnaire administered for respondent view.

TAROYAMINE (1964) formula is used to determine the sample size for research TARO (1964) method.

$N = N (1+N(e)^2$

Where n = sample Size (30)

N = total population

E = Error Limit (0.05 on the basis of 95% confident level

I = Constant

$$\frac{1 + N\ 2\ N}{Ce}$$

$$1 + \frac{30}{(0.05)^2\ 30}$$

$$\frac{30}{1 + (0.0025)^2(30)}$$

$$\frac{30}{1.25} \quad N = 24 = 24$$

3.6 Sampling Size

The sample size is a reasonable number of selected trait, event or members taken from population as a representative of that population, so the sample for the study will be Thirty (30) selected personnel. A Simple random sampling was used to select population elements.

3.7 Research Instrument

The instrument for this research work is the use of questionnaire. Which consists of section A and Section B. the Section A deals with the Bio-data of respondents while the section B deals with the Research Based question on the research topic.

3.7.2 Measurement of Variable

The variable measure in the case of this research work is the use of questionnaire, which was embed in table designing, which consist of row and column

3.8 Data Collection Techniques

Data collection techniques for this research project includes primary and secondary sources of data collection. Primary sources of data are sources of data collected through oral interview, questionnaire administration and some form of electronic communication between the researcher and the respondents in the organization. The researcher urged the respondents to respond honestly to the question administered.

Secondary sources of data are the information that have already been recorded in the subject data in various document including books, journals and annual reports of the organization.

3.9 Data Analysis

The researcher used the percentage method as statistical techniques to analysed and interpreted the data collected.

The statistical tool that suits this project is space man's rank correlation and is used to determine the relationship between two qualitative data.

Preparation of Snacks

- Peel the unripe plantain
- Cut it into pieces
- The pot on fire then pour the plantain and add water, boil until it soft
- After the plantain as soft add the pepper, and the ingredients e.g. salt, maggi, Palm oil, crayfish, ugu etc
- Boil until it done and give the good taste, add more salt if needed.

Preparation of Amala

Put the clean pot on fire, add water, let the water boil very well

Add the plantain flour and turn it very well not too tick and not too soft.

Preparation of Egusi Soup

- Put the clean pot on fire
- Add the palm oil

- Add pepper
- Add the grounded egusi
- Add ingredients, (salt, maggi, crayfish)
- Add the boil beef
- Add ugu
- Cook until it done

Equipments Needed

Gas, Pot, Spoon, Turning Stick, Bowl, Bucket,

Uses of Unripe Plantain In Hospitality Industry

- It helps to manage diabetes
- It helps to boost libido
- Good for pregnant women
- It helps cure stomach ulcers
- Helps in weight loss
- It helps to prevent constipation
- It helps in the building of stronger bones and teeth
- It is heart friendly.

3.10 Methodology of Sensory Evaluation

Sensory evaluation for the Unripe Plaintain are done using effective testing through the design of a structured questionnaire to carefully selected panels of persons recruited for this type of testing after consumption.

The questionnaire consists of the following structured sensory evaluation firm as shown below;

Direction; click one rating for each of the following; appearance, taste/flavour, texture /consistency and overall acceptability.

Section A

1. **Sex: Male ( ) Female ( )**
2. **Age:** 20-30 ( ) 31-40 ( ) 41-50 ( ) 51 years and above ( )
3. **Marital Status:** Single ( ) Married ( )
4. **Educational Qualifications:** SSCE ( ) ND/NCE ( ) HND/B.Sc ( ) Other ( )

Part B

Table 1: Amala in Frequency

The number of the observed used was 20 numbers

Variable	**Excellent**	**Very Good**	**Good**	**Fair**	**Poor**
Appearance					
Taste					
Flavour					
Texture					
Acceptability					

Table 2: Chips Snacks in Frequency

Variable	**Excellent**	**Very Good**	**Good**	**Fair**	**Poor**
Appearance					
Taste					
Flavour					
Texture					
Acceptability					

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.1 Introduction

The research sensory evaluation questionnaires were distributed to some randomly selected staff and students of the hospitality management department in Kwara State Polytechnic, Ilorin. A total of twenty (24) questionnaires were fully administered of which 20 out of the total copies distributed were answered and returned back to the respondents after affective testing of the Amala and snacks from unripe plantain.

The unripe plantain was gotten from Mandate Market, Ilorin

The Amala was tested separately, while the snacks were tested separately.

4.2 Data Analysis and Results

The following data were presented and analyzed. Data presentation were made under the sensory evaluation data.

SECTION A: Bio Data of Respondents

Table 4.1. Sex of Respondents

Sex	**Frequency**	**Percentage (%)**
Male	8	40%
Female	12	60%
Total	**20**	**100%**

Source: Field Survey, 2025

The data shows that the majority of respondents were female (60%), while males made up 40%.

Table 4.2. Age of Respondents

Age Range	Frequency	Percentage (%)
20–30 years	14	70%
31–40 years	4	20%
41–50 years	1	5%
51 years & above	1	5%
Total	**20**	**100%**

Source: Field Survey, 2025

Most respondents fall within the 20–30 years age range, indicating that younger adults are more involved or interested in the subject.

Table 4.3. Marital Status of Respondents

Marital Status	Frequency	Percentage (%)
Single	15	75%
Married	5	25%
Total	**20**	**100%**

Source: Field Survey, 2025

The majority (75%) of the respondents are single, while 25% are married.

Table 4.4: Educational Qualifications

Qualification	Frequency	Percentage (%)
SSCE	2	10%
ND/NCE	14	70%
HND/B.Sc	3	15%
Others	1	5%
Total	**20**	**100%**

Source: Field Survey, 2025

A large portion of respondents holds an ND/NCE or higher qualification, indicating a relatively educated sample group.

4.3 Section B: Sensory Evaluation and Data Analysis Sensory Evaluation of Amala from Unripe Plantain

The following statistical results are obtained from the analysis of the Sensory evaluation data of Amala from unripe plantain:

Table 4.5: Appearance of Amala From Unripe Plantain

Response	Number of Respondents	Percentage %
Excellent	5	25%
Very Good	5	25%
Good	3	15%
Fair	3	15%
Poor	4	20%
TOTAL	20	100%

Source: Field Survey, 2025

The table 1 above simply shows that 5 respondents representing 30% rated the experimental Amala from unripe plantain 5 respondents representing 30% rated the experimental Amala from unripe plantain very good. However, 3 respondents representing 30% of the total sensory evaluators rated the Amala from Unripe plantain Good while 3 respondents representing 10% of the total sensory evaluators rated the Amala from Unripe plantain fair. The remaining 4 respondent representing 20% rated the experimental Amala from unripe plantain poor.

Table 4.6: Taste Of Amala from Unripe Plantain

Response	**Number of Respondents**	**Percentage %**
Excellent	8	40%
Very Good	8	40%
Good	4	20%
Fair	-	-
Poor	-	-
TOTAL	20	100%

Source: Field Survey, 2025

The table 2 above shows that 8 respondents representing 40% of the total sensory evaluators rated the Taste of the experimental Amala from Unripe plantain excellent. However, 8 respondents representing 40% of the total sensory evaluators rated the Amala from Unripe plantain Very Good while 4 respondents representing 20% of the total sensory evaluators rated the Amala from Unripe plantain Good.

Also, no respondents representing rated the Amala from Unripe plantain fair while No respondent rated the Taste of experimental Amala from Unripe plantain poor.

Table 4.7: Texture of Amala from Unripe Plantain

Response	**Number of Respondents**	**Percentage %**
Excellent	5	25%
Very Good	4	20%
Good	9	45%
Fair	1	5%
Poor	1	5%
TOTAL	20	100%

Source: Field Survey, 2025

The table 3 above shows that 5 respondent representing 25% of the total sensory evaluators rated the texture of the experimental Amala from Unripe plantain excellent. However, 4 respondents representing 20% of the total sensory evaluators rated the Amala from Unripe plantain Very Good while 9 respondents representing 45% of the total sensory evaluators rated the Amala from Unripe plantain Good. Also, 1 respondents representing 5% of the total sensory evaluators rated the Amala from Unripe plantain fair while the remaining 1 respondent representing 5% rated the Texture of experimental Amala from Unripe plantain poor.

Table 4.8: Aroma of Amala from Unripe Plantain

Response	Number of Respondents	Percentage %
Excellent	4	20%
Very Good	7	35%
Good	6	30%
Fair	2	10%
Poor	1	5%
TOTAL	20	100%

Source: Field Survey, 2025

The table 4 above shows that 4 respondents representing 20% of the total sensory evaluators rated the Aroma of the experimental Amala from Unripe plantain excellent. However, 7 respondents representing 35% of the total sensory evaluators rated the Amala from Unripe plantain Very Good while 6 respondents representing 30% of the total sensory evaluators rated the Amala from Unripe plantain Good. Also, 2 respondents representing 10% of the total sensory evaluators rated the Amala from Unripe plantain fair while the remaining respondents rated the Aroma of the experimental Amala from Unripe plantain poor.

Table 4.9: General Acceptability of Amala from Unripe Plantain

Response	Number of Respondents	Percentage %
Excellent	4	20%
Very Good	6	30%
Good	8	40%
Fair	2	10%
Poor	-	-
TOTAL	20	100%

Source: Field Survey, 2025

The table 5 above shows that 4 respondent representing 20% of the total sensory evaluators rated the general acceptability of the experimental Amala from Unripe plantain excellent. However, 6 respondents representing 30% of the total sensory evaluators rated the Amala from Unripe plantain Very Good while 8 respondents representing 40% of the total sensory evaluators rated the Amala from Unripe plantain Good. While the remaining 2 respondents representing 10% of the total sensory evaluators rated the Amala from Unripe plantain fair. No respondents rated the experimental Amala from Unripe plantain poor.

Sensory Evaluation of Snacks from Unripe Plantain

This part of this research work will vividly examine the sensory evaluation of Snacks under the following headings:

- Appearance >Taste >Texture
- Aroma >General Acceptability

Table 4.10: Appearance of the Experimental Snacks

Response	**Number of Respondents**	**Percentage %**
Excellent	2	10%
Very Good	9	45%
Good	7	35%
Fair	1	5%
Poor	1	5%
TOTAL	20	100%

Source: Field Survey, 2025

The table 6 above shows that 2 respondents representing 10% of the total sensory evaluators rated the appearance of the experimental Snacks from unripe plantain excellent. However, 9 respondents representing 45% of the total sensory evaluators rated the snacks from unripe plantain very good while 7 respondents representing 35% of the total sensory evaluators rated the Snacks Good. Also, 1 respondents representing 5% of the total sensory evaluators rated the Snacks from Unripe plantain fair while the remaining 1 respondent rated the appearance of the experimental Snacks poor.

Table 4.11: Taste Of Snacks from Unripe Plantain

Response	Number of Respondents	Percentage %
Excellent	3	15%
Very Good	6	30%
Good	8	40%
Fair	1	5%
Poor	2	10%
TOTAL	20	100%

Source: Field Survey, 2025

The table 7 above simply shows that 3 respondents representing 15% rated the experimental Snacks from unripe plantain 6 respondents representing 30% rated the experimental Snacks very good. However, 8 respondents representing 40% of the total sensory evaluators rated the Snacks from Unripe plantain Good while 1 respondents representing 5% of the total sensory evaluators rated the Snacks from Unripe plantain fair. The remaining 1 respondent representing 10% rated the Snacks poor.

Table 4.12: Texture of the Experimental Snacks from Unripe Plantain

Response	Number of Respondents	Percentage %
Excellent	4	20%
Very Good	10	50%
Good	5	25%
Fair	1	5%
Poor	-	-
Total	20	100%

Source: Field Survey, 2025

The table 8 above shows that 4 respondents representing 20% of the total sensory evaluators rated the Texture of the experimental Snacks excellent. However, 10 respondents representing 50% of the total sensory evaluators rated the Snacks from Unripe plantain Very Good while 5 respondents representing 25% of the total sensory evaluators rated the Snacks from Unripe plantain Good. Also, the remaining 1 respondents representing 5% rated the Snacks from Unripe plantain fair while No respondent rated the Texture of experimental Snacks from Unripe plantain poor.

Table 4.13: Aroma of Snacks from Unripe Plantain

Response	Number of Respondents	Percentage %
Excellent	5	25%
Very Good	6	30%
Good	7	35%
Fair	1	5%
Poor	1	5%
TOTAL	20	100%

Source: Field Survey, 2025

The table 9 above shows that 5 respondent representing 25% of the total sensory evaluators rated the aroma of the experimental Snacks from Unripe plantain excellent. However, 6 respondents representing 30% of the total sensory evaluators rated the Snacks from Unripe plantain Very Good while 7 respondents representing 35% of the total sensory evaluators rated the Snacks from Unripe plantain Good. Also, 1 respondents representing 5% of the total sensory evaluators rated the Snacks from Unripe plantain fair while the remaining 1 respondent representing 5% rated the aroma of experimental Snacks from Unripe plantain poor.

Table 4.14: General Acceptability of the Experimental Snacks from Unripe Plantain

Response	Number of Respondents	Percentage %
Excellent	6	30%
Very Good	8	40%
Good	6	30%
Fair	-	-
Poor	-	-
Total	20	100%

Source: Field Survey, 2025

The table 10 above shows that 6 respondent representing 30% of the total sensory evaluators rated the general acceptability of the Snacks from Unripe plantain excellent. However, 8 respondents representing 40% of the total sensory evaluators rated the Snacks from Unripe plantain Very Good while 6 respondents representing 30% of the total sensory evaluators rated the experimental Snacks from Unripe plantain Good. Also, no respondents choose fair, likewise no respondents choose poor.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of Findings

From the study so far, physiochemical properties of unripe and ripe plantain has given details on the proximate analysis and functional properties of the flour. The proximate analysis shows that unripe plantain has less moisture content than ripe plantain flour. The ash content of the sample is the same, the ripe plantain flour has more lipid content than unripe, the crude protein content as the same they have the same carbohydrate content as well as mineral content.

The functional properties where moisture of the samples differs with the ripe having more moisture than the unripe flour, the swelling power and solubility shows that unripe flour has higher swelling power and solubility than ripe, the unripe plantain shows higher binding capacity than the ripe one, ripe plantain flour has higher pH than unripe plantain flour, unripe plantain flour has higher rehydration than ripe plantain.

Plantain contains many health benefits social and economic benefit, it contains a good percentage of the basic food nutrients which includes energy, carbohydrates, sugars, dietary fibre, fat, protein, vitamins, minerals and water.

Plantain comes in varying varieties which makes it a useful fruit which can either be eaten raw when riped, cooked or added to enhance meal presentation and also made into flour.

5.2 Conclusion

It should be noted that plantain flour is a very scintillating meal, which production should be encouraged by the government in other to fully explore the country's plantain because there have been little utilization of the fruits and other possibilities of production of flour from it is being ignored.

This research therefore has drawn the attention of Nigerian populace to the possibility of adding plantain flour to the meals and also for the production of different types of snack. The research thereafter shows that the product obtained from the flour, show a very good taste and has good health benefits.

5.3 Recommendations

The following recommendations will be made based on findings from this research work:

- There should be more awareness and enlightenment programs on the importance of maximizing Nigerian available fruits especially plantain.
- Government should support research institutes the research grant to be used in discovering new food products in order to reduce food costs and ensure food security to Nigeria populace.
- Government should also make equipment and machines available to those institutes and institutions who have interest in this line of business.
- Government should help in encouraging production equipment and machines also introducing duty free passage of the equipment and machines.

- There should be adequate storage facilities and good transportation so as to reduce the level of wastage as many of this fruits get spoilt in this process.
- There should be awareness on the use of ripe plantain as flour as the populace are only familiar with the use of unripe plantain only which brought about lot of ripe plantain being wasted. If this is done, it will lead to more utilization of our products.

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