UTILIZATION OF WHOLE UNRIPE PLANTAIN FOR PRODUCTION OF AMALA AND PORRIDGE IN TREATMENT OF DIABETIC

BY

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BEING A PROJECT SUBMITTED TO THE DEPARTMENT OF HOSPITALITY MANAGEMENT, INSTITUTE OF APPLIED SCIENCES (IAS), KWARA STATE POLYTECHNIC, ILORIN

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CERTIFICATION

This is to certify that the Project was read and approved as meeting the requirement of Department of Hospitality Management, Institute of Applied Sciences (IAS). Kwara State Polytechnic, Ilorin, for award of National Diploma (ND) in Hospitality Management.

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DEDICATION

This project work is dedicated to Almighty God who gave me the ability to write this project and to my family who have been supporting me from the beginning till this present moment I am now.

-

ACKNOWLEDGMENT

All thanks and adoration to Almighty God for everything he has done in my life. Thank God for giving me the strength, focus and faith that have accompanied me over the years and that have not allowed me to give up.
I will be forever grateful to Almighty God for the all the blessings on my family.
I will like to thank my parent **MR and MRS. ISHOLA** for being my greatest motivator.

I am grateful for all the encouragement and all the daily prayers that you have dedicated to me for being my biggest financial supporter thanks for always being by my side.
I want to show appreciation to my siblings and friends who believed in my dreams and gave me the strength, everyday and for their biggest support on my education, my lovely brother and Small Daddy **ISHOLA ADEOLU PETER**, **MR. and MRS. ASHAOLU,** Lovely Sister **ISHOLA ESTHER**, My Friends **GRACE OLAYIOYE, and SUNDAY ADEGBOYEGA** for their love and caring towards my entire life.

I would like to express my sincere gratitude to my supervisor who happens to be my Examiner the person of **MRS. ADEBAYO S.M** for her enthusiasm, patience, support, helpful information, practical advice and helped me tremendously all time in my research project. and to all the lectures in my department may Almighty God bless you all and May God answers all your secret prayers. In Jesus Name

This work belongs to you all (I love you

ABSTRACT

Unripe plantain flour (UPF) is hygroscopic and gets spoilt if not correctly processed, packaged and stored. Thus, the need to study the functional and pasting properties of the UPF, and the sensory attributes of the cooked paste (amala) as affected by packaging materials and storage periods. The UPF was produced using the standard method, packaged in a polypropylene woven sack (PPS) and polyvinyl chloride container (PVC), stored for 20-weeks at room temperature and analyzed at 4-weeks intervals. Results showed that the solubility index of UPF packaged in PPS had a significant (P - 0.02) positive correlation with the breakdown viscosity (r = 0.90), and a negative correlation with molidability (r=- 0.89), mouth feel (r = -0.92) and the overall acceptability (r = -0.83) of the amala. The peak viscosity of the UPF packaged in PPS had a significant (P < 0.05) negative correlation with the stretchability (r = —0.93), mouldability (r = -0.88). mouthfeel (r = 083) and overall acceptability (r = -0.01) of the amala. The packaging materials and storage periods had significant effect (p < 0.05) on the mouldability of the amala. The overall acceptability was higher in the amala prepared from PPS packaged UPF compared to that of the PVC.
Therefore, UPF should be stored in PPS to retain its sensory attributes.

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CHAPTER ONE

1.1 Introduction

Diabetes mellitus is a global metabolic disease that affects essential biochemical pathways in the body resulting to complications. Excess hepatic glycogen accumulation is seen in 80% of diabetic patients due to impaired glycogen synthesis and this could be a leading cause of liver disease in diabetics. Patients showing solely excessive glycogen deposition may exhibit hepatomegaly and liver enzyme abnormalities which are improved with sustained glucose control.

Though synthetic drugs have been useful in the management of this disease, their use is limited by the side effects associated with them as well as the enormous cost they pose on the economies of developing nations. Moreover, these therapies only partially compensate for metabolic derangements seen in diabetics and do not necessarily correct the fundamental biochemical lesions Chatila et al., 1996. Therefore, the need for alternative therapies cannot be overemphasized.

Plantain is cultivated in many tropical countries of the world, and it is known to be rich in iron, fiber, vitamins, minerals, and serotonin.

In folklore medicine, unripe plantain is useful in the management of diabetes. treatment of anemia, and liver disorders (independent of diabetes).

Although the antidiabetic potentials of unripe plantain on animal models have been reported, the biochemical basis of its folkloric use in the management of diabetes and liver dysfunctions has

not been fully investigated. In addition, there is paucity of information in literature on the effect of unripe plantain on hepatic dysfunction arising from diabetes or other sources (alcohol, virai hepatitis or demographic factors). Since the incidence of hepatic complications arising solely from diabetes mellitus is gradually on the increase and though it is most prevalent in patients of type 2 diabetes, results obtained from this study could

provide an insight into the prospects of unripe plantain in the management of hepatic dysfunction arising from type 2 diabetes.

This research was therefore setup to study the effect of unripe plantain on blood and urinary glucose, serum amylase, lipase, body weights, relative liver, kidney, pancreas and heart weights, serum total and conjugated bilirubin, serum and hepatic aspartate amino transaminase (AST), alanine amino transaminase (ALT) and alkaline phosphatase (ALP) activities in streptozotocin induced diabetic rats.

1.2 Background to the study

Diabetes mellitus is a chronic metabolic disorder that is characterized by hyperglycemia which results from insufficient or inefficient insulin secretion and causes alterations in carbohydrate, protein, and lipid metabolism (Shobana et al., 2009). However, NIDDM (non insulin dependent diabetes mellitus) is the most common form of diabetes. accounting for 90% of all cases, and is a metabolic disorder primarily characterized by insulin resistance, relative insulin deficiency, and an abnormal rise in blood sugar, right after a meal, calledpostprandial hyperglycemia (Kwon et al., 2007).

Recent reports have revealed that hyperglycemiacould induce non enzymatic glycosylation of various macromolecules, generation of reactive oxygen species, and alteration of endogenous antioxidants, which could lead to chronic complications (Lebovitz, 2001). Pancreatic a-amylase breaks down large polysaccharides (starch) into disaccharides and oligosaccharides, before the action of a-glucosidase break down disaccharides into monosaccharides (glucose) which is readily absorbed into the blood stream. Inhibition of pancreatic a-amylase and a-glucosidase is the mechanism adopted by many commercially available drugs for themanagement of NIDDM (Krentz and Bailey, 2005). The drugs that are currently used as a-amylase and a-glucosidase inhibitors exhibit side effects such as abdominal distension, bloating, flatulence and diarrhea (Chakrabarti

and Rajagopalan, 2002., Kimmel and Inzucchi, 2005) which are linked to excessive inhibition of the pancreatic a-amylase (Bischofl, 1994).

However, isolated natural inhibitors of the enzymes have been reported to be effective in decreasing postprandial hyperglycaemia with minimal side effects (Kwon et al., 2006). Hence, natural a-amylase and a-glucosidase inhibitors offer an attractive therapeutic approach to the treatment of NIDDM by ultimately slowing the degradation of starch to glucose. This necessitates the search for natural inhibitors with strong a-glucosidase, but mild a-amylase activities.

Hypertension is a firsthand complication of NIDDM. Angiotensin I converting enzyme (ACE) (EC 3.4.15.1) plays an important physiological role in regulating blood pressure. 1 ACE belongs to the class of zine proteases which is expressed in the vascular endothelial lining of human lungs. ACE is a dipeptidyl carboxypeptidase that catalyzes the conversion of angiotensin I (decapeptide) to angiotensin II (octapeptide), it inactivates the antihypertensive vasodilator bradykinin, thereby increasing blood pressure. Inhibition of ACE activity leads to a decrease in the concentration of angiotensin II and consequently reduces blood pressure (Skeggs and Khan, 1957). In addition, inhibition of ACE is considered a uselul therapeuuc approach in the treatment of high blood pressure in both diabetic and non diabetic patients, (Johnston and Franz, 1992) and dietary intervention with the use of could be a readily available means of preventing and/or managing diabetes and hypertension. Previous in vitro and in vivo animal and clinical studies have also demonstrated the potency of specific phenolic phytochemicals in hypertension management with direct absorption into the blood (Kwon et al., 2006).

Plantain (Musa paradisiaca) is knownas plantain (English), ogede agbagba (Yoruba), ayaba (Hausa) and Ogadejioke (Igbo). It is aperennial tropical plant that is native to India.

The plant consists of long, overlapping leafstalks with a stem which is 1.22 to 6.10 m high while the leaves grow to a length of 1.83 m and 0.61 mwide. The fruits grow in clusters

and each separate plantain is about 1 inch in diameter but somewhat longer than a banana (Gill, 1992). The fruit of unripe plantain is used in folklore medicine for treating diarrhoea, dysentery, intestinal lesions in ulcerative colitis, diabetes, uremia, nephritis, gout, hypertension and cardiac disease (Ghani, 2003). In Nigeria, it is very common to find Nigerian diabetics consuming unripe plantain meal to reduce postprandial glucose level. This is because the propensity of individuals to develop diabetes and obesity is due to the increased consumption of carbohydrate rich foods with a high Glycemic index (Willet et al., 2002).

Plantain fruits are good sources of plant phytochemicals. (Ghani. 2003) which promote health and well-being. Phenol rich foods could protect against certain chronic degenerative diseases (Dykes and Rooney, 2007). Recently, plant phytochemicals such as phenols have been reported to inhibit key enzymes linked to type 2 diabetes (Kwon et al., 2007). Plantain fruits can be consumed as ripe or unripe in several forms; it is either boiled, fried, roasted, steamed, baked or grilled. Other products derived from plantain could be in form of chips and hour Nwokocha and Williams, 2009). When processed into flour, it is used traditionally for preparation of gruel which is made by stirring the flour with appropriate quantities of boiling water to form a brown thick paste (Idowu et al., 1996) which is known locally as 'amala'. Beside these forms of use; Plantain flour is now used as a functional agent in bakery products (Akubor, 1998). During the production of plantain flour, plantain shows strong enzymatic browning reactions when cut and exposed to the air (Ozo et a., 1984). This browning is caused by enzyme tyrosinase which oxidizes the amino acid tyrosine into 3,4-dihydroxyphenyalanine and further application of heat (i.e reconstitution of plantain flour in boiling water) eventually leads to the formation brown melanoidin compounds (Zakpaa et al., 2010). Recent studies have revealed that partial enzymatic oxidation (Manzocco et al., 1998) and non-enzymatic (melanoidins) browning exhibit antioxidant properties (Yen and Tsai, 1993).

The consumption of the plantain and its product is now on the increase even though it could be eaten singly. Nigerians have adopted various means of including it in their various meals as part of their diet. As mentioned above, it could be processed into various products to facilitate its diverse use. Various analyses has been carried out on plantain but as at the time of this study there is no information on theantioxidant and enzymatic activities of free and bound phenolics from unripe plantain and its products. Hence, this study was carried out to investigate the antioxidant and enzymatic activities of free and bound phenols in the inhibition of the key enzymes linked to type 2 diabetes and hypertension. The plantain porridge is particularly good for diabetics because of its low sugar but high resistant starch contents, they have so many health benefits and can be eaten on a variety of ways (Adeolu and Enesi 2003).

1.3 Statement of Problem of the Study

Plantain flour can be reconstituted in boiled water to form a gelatinized paste called "Amala" in Yoruba which can be eaten with different soups or sauce, unripe plantain tour is also used to several other traditional dishes.

The deand for unripe plantain flour has increased tremendously because of its health benefits.

The major problem we encounter during the process as follow:

i. Unripe plantain flour is hygroscopic and it gets spoilt if not correctly processed, packaged
and stored.

ii. It is envisaged that the sensory acceptability of plantain in Amala may be affected by the
changes in the functional and pasting properties of the packaged flour during storage.

The need to evaluate the functional and pasting properties of the unripe plantain flour.

The sensory attributes of the cooked paste (Amala) as affected by packaging materials and storage period.

Therefore, research work will fix the problem of unripe plantain for processing Amala and Porridge food for the treatment of diabetes through the use of hygienically processed in a way that unripe plantain flour should be stored.

Research Question.

What are the methods to follow to create awareness on unripe plantain with the use of mechanized equipment.

i. What are the major steps to follow in the extraction of in unripe plantain

ii. How can the extracted flour be accepted for food preparation

Aims and Objectives of this Project

The aim and objectives of this study are as follow:

i. To produce Amala and porridge through unripe plantain.

ii. To identify the utilization of unripe plantain for production of Amala and porridge in the treatment of diabetic.

iii. Identify the unripe plantain oriented product are utilized when available by converting into Amala and porridge which can be eating when the unripe plantain are no longer in seism.

iv. To evaluate the functional and pasting properties of the unripe plantain flour

1.6 Significance of the study

Based on the fact that Amala and poridge can be obtained from unripe plantain, this study deals with how to produce Amala and poridge from palm unripe plantain to imestigate if thie product would be preferred over the treatment of diabetic.

1.7 Scope and limitation of the study

This research work one main fruit from which unripe plantain is extracted and mixed together to produce Amala

Therefore, the intention of this research study is to produce Amala and Porridge through unripe plantain

1.8 Limitation of the study

This means what cannot be achieved and some factors that can constrain the researcher during the period of carrying out the research work, such as:

1. Financial problem- Insufficient fund to get the material that is needed to carry out the practical
2. Time constraints- Limited time available to carryout the research work

1.9 Definition of Terms

Utilization: Utilization is the primary technique wherein success and performance efficiency are determined. This is especially in the case with tools and equipment. The term is also used to describe the act of using materials, products and services to make things function, extend the lifespan of machineries, improve durability of materials and other things that can lead to better performance and less risk of damage.

Unripe Plantain: This also known as (Musa paradiasica) is an incredible superfood belonging to the banana family. They are parts of the staple diet in Africa, Asia, and Latin America. You can find plantains largely grown in Uganda, Nigeria, Ghana, and Rwanda. The unripe or green plantain is particularly good for diabetics because of its low sugar but high resistant starch content.

Production: Production is the process of making or manufacturing goods and products from raw materials or components. In other words, production takes inputs and uses them to create an output which is fit for consumption

Diabetes: is a disease that occurs when your blood glucose, also called blood sugar, is too high. Blood glucose is your main source of energy and comes from the food you eat. Insulin, a hormone made by the pancreas, helps glucose from food get into your cells to be used for energy.

Treatment: This means the management and care of a patient to combat disease or disorder

Unripe plantain porridge: This is a dish made by heating or boiling ground, crushed, or chopped starchy plantain, it is often cooked or served with added flavouring such as sugar, honey (dwed) fruit or syrup to make a sweet cereal.

CHAPTER TWO

LITERATURE REVIEW

2.1 Unripe Plantain

Unripe plantain is a natural source of resistant starch that helps to reduce blood glucose levels, so it is considered an excellent ingredient for food fortification.

Unripe plantain (Musa paradiasica) is an incredible superfood belonging to the banana family.

They are part of the staple diet in Africa, Asia, and Latin America. You can find plantains largely grown in Uganda, Nigeria, Ghana, and Rwanda.

The unripe or green plantain is particularly good for diabetics because of its low sugar but high resistant starch content. Unlike bananas, unripe plantains must be cooked before eating.

They have so many health benefits and can be eaten in a variety of ways (Adeolu & Enesi, 2013).

2.1.1 Amala

Àmalà is a local indigenous Yoruba food, native to the Yoruba ethnic group. It is made out of yam and/or cassava flour, or unripe plantain flour (Balogh et al., 1999). Yams are peeled, sliced, cleaned, dried and then blended into flour, also called lubo. Yams are white in colour but turn brown when dried. This gives amalà its colour (Ferris et al., 1995) Àmalà is consumed by the Yoruba people in Nigeria. Amala is native to indigenous people of the Southwestern part of Nigeria it could be served with a variety of obe (soups), such as fo, ilá, ewédú, ogbono, and or gbegirì (black-eyed beans soup).

Amala is a nigerian food mostly eaten by the Yoruba people. It is so common that you can always get it in most restaurants and bukkas in the cities, especially Lagos and Ibadan, even people from other tribes enjoy eating it. It is made out of yam flour (elubo).

2.1.2 Porridge

Porridge is a food made by heating or boiling ground, crushed or chopped starchy plants, typically grain, in milk or water. It is often cooked or served with added flavourings such as sugar, honey, (dried) fruit or syrup to make a sweet cereal, or it can be mixed with spices. meat vegetables to make a savoury dish. It is usually served hot in a bowl, depending on its consistency (Mariotti Lippi et al., 2015). Oat porridge, or oatmeal, is one of the most common types of porridge. Gruel is a thinner version of porridge.

Historically, porridge was a staple food in much of the world, including Europe and Africa, and it remains a staple food in many parts of the world. The most ancient evidence of porridge dates back to paleolithic hunter-gatherers in Southern Italy, (Welch ET AL., 1998) becoming more commonplace during the neolithic. The dish has traditionally been closely associated with Scotland, possibly because oats can be successfully cultivated on marginal upland soils. In 1775, Dr. Samuel Johnson wrote that oats were "a grain which in England is generally given to horses, but in Scotland supports the people".Oats were introduced to Scotland in about 600 AD, but traces of barley porridge have been found in pots excavated in the Outer Hebrides which have been dated to 2,500 years ago.

2.2 General Method of Preparing Unripe Plantain Flour

Amala and porridge

AMALA

Ingredient for AMALA

2 green plantain peel, and into chunks

¾ cup cold water or more

Instrument

1. Cut off the tips of the plantains (both sides)
2. Make a slit down on the plantain and use your thumb to peel off the peel.

3. Cut the plantain into chunks or big slices repeat the process with the second plantain.

4. Add to clean blender and blend, slowly add water start with about a ¼ cup of water then increase as you blend. The size of the plantains will determine the quantity of water needed

but make sure you only add water to aid blending.

5. Pour the plantains into a pan preferable non-stick pan and cook over medium high heat, using

a flat wooden ladle (Orogun) to continuously turn as the plantain cook.

6. As the plantains cook, you will notice the change in colour if it's ton hard" and a small quality

of water and stir until its fully cooked.

7. Take of heat and scoop out from the pot. The colour of unripe plantain fufu on Amala will be

determine by the plantain. So don't fret if the colour you get is different each time you prepare

it

2.2.1 Ingredient For Unripe Plantain Porridge

i. 6 Fingers of unripe plantain
ii. 1 Finger Semi Ripe or Ripe Plantain
iii. 2 Medium Sized Onions
iv. 1 Habenero Pepper
v. 1 Medium red bell Pepper
vi. 1 Cup Palm Oil vii. Salt/ bovilon powder to taste
vii. 2-3 handful kale leaves Optional.
viii. 8 cups of waste

ix. ½ cup of coarsely ground crayfish

2.2.2 Instrument:

1. Peel the ripe plantain chop into cubes and set aside.
2. Peel the unripe plantains, chop into cubes and put in a pot filled with 8 cups of water then
   place over a lit up stove and start cooking.
3. Chop half of I onion and add to the pot with ½ cup of crayfish and bovillon powder to taste.
   Allow to cook.
4. While you wait chop up onion and pepper and prepare my ultimate onion pepper mebley sauce
   recipe here.
5. About 10 mins into the cook time, add the diced ripe plantain into the pot.
6. 2 mins to the end cooking time, add the chopped red bell pepper and mix it the onion pepper
   sauce, stir and taste for seasoning. Adjust according.
7. If you choose to use green vegetable like kale or spinach. this is the time to add it
8. Stir and turn off the heat food is ready.

2.2.3 Porridge in the Treatment of Diabetic

Unripe or green plantain porridge is loaded with dietary fiber, vitamins, minerals, and antioxidants. Although they are more starchy than bananas, their high carbohydrate content consists mostly of resistant starch- type of dietary fiber.

According to the United State Department of Agriculture (USDA), I large-sized raw, green unripe plantain (267 grams) will give you.

i. Energy: 406kcl
ii. Water: 163 grams (g)
iii. Fats: 0.2g
iv. Protein: 3g
v. Carbohydrate: 98g
vi. Dietary fiber: 6g
vii. Sugar: 6g
viii. Potassium: 1150mg (milligram)
ix. Magnesium: 109mg
x. Phosphorus: 82mg
xi. Iron 2mg
xii. Sodium: 5mg
xiii. Vitamin C (Abcorbic Acid): 54mg
xiv. Folate: 74 micrograms

Health benefits of unripe plantain porridge

The following are benefits of eating unripe plantain:

1. High in antioxidents

Plantain porridge are incredibly rich in antioxidants antioxidants are compound that help fight free radical that cause oxidative damage in the body.

One study found that the peel and flesh of plantain porridge contain flavonoids and polyphones two important.

Important antioxidants are important because they help light me tabolic disorders like diabele, cancer, and heart disease.

2. Great food for Diabetes

Unripe plantain porridge are high in resistant is starch, which gives them low glycemic index (GI) of 45 when boiled.

Resistant starch is a type of carbohydrates that does not beak down into sugar in the small intestine but posses into the large intestine where fermentation occurs.

Because resistant starch is not digested in the small intestine. It does not raise blood glucose levels, making it an ideal food for diabetes.

Additionally, fermented in a large intestine improves glycemic control by promoting the growth of "good" gut bacteria.

3. Controls blood pressure

Plantain porridge is rich in potassium an important mineral that helps to control hypertension.

Large-sized green plantain porridge will provide your with about 44% of the daily value of potassium needed in a day.

Also since they are low sodium foods plantain support a hypertension diet.

4. Improve digestive health

Both the fiber and resistant starch in plantain porridge helps promote digestive regularity.

It high fiber content helps matter move easily through the digestive tract preventing constipation and colon cancer.

5. Promote weight loss

The high resistant starch content of fullness and helps you to eat less.

So if you are trying to loss. It promotes a feeling of fullness and helps you to eat less. weight load up on healthy curbs like unripe plantain.

2.3 Processing of Unripe Plantain Fingers into Unripe Plantain Flour

Fresh and healthy green bunches of the plantain fruits were detached from the peduncle. The fruits were de-fingered from the hands and washed to remove adhering dirt and possible chemical residue and latex (which may have exuded from the cut surface of the crown). The plantain fingers were peeled manually with the aid of a stainless knife and submerged in water until the peeling process was completed. The fingers were sliced longitudinally to about 15 mm thickness with a stainless steel knife to enhance dehydration.

The sliced plantain was dried in a moisture extraction oven at 60 °C for about 48 h, after which it was milled and sieved to obtain the flour as described by Ndayambaje et al. (2019).

The unripe plantain flour (UPF) was then prepared for the storage studies.

2.3.1 Storage Studies of Unripe Plantain Flour

Five hundred grams (500 g) of UPF were weighed and packaged separately in PPS and properly sealed, and PVC container sealed with the lid. These packaging materials were stored at room temperature for 20-weeks. The functional and pasting properties of the UPF and the sensory attributes of the amala were evaluated every 4-weeks of the 20-weeks storage periods (Awoyaleet al., 2020).

2.4 Determination of Functional Properties of Plantain Flour

2.4.1 Bulk Density

Bulk density was determined using the standard methods described by Ashraf et al. (2012). Floursample (10 g) was measured into a graduated measuring cylinder (50 mL) and lightly tapped on the workbench (10 times) to attain a constant height. The bulk density was then recorded and expressed as grams per milliliter.

2.4.2 Swelling Power and Solubility Index

For the determination of swelling power and solubility index, aqueous UPF sample dispersions of2.5% were put in centrifuge tubes, capped to prevent spillage. and heated in a water bath with shaker (Precision Scientific, Model 25: Chicago, USA) at 85°C for 30 min.

(Afoakwa et al., 2012). The tubes were cooled to room temperature and centrifuged (Thelco GLC- 1, 60647: Chicago, USA) at 3,000 rpm for 15 min. The weight of the precipitated paste separated from the supernatant was taken (Wp), after which a hot air oven (Memmert GmbH+Co.KG: D-91126, Germany) was used to evaporate the supernatant at 105 °C, and the residue weighed (Wr). The swelling power (SP), and solubility index (SI) was then calculated as:

Sp ¼ wt of precipitated Pasteo W:- wt of supernatanto WRWt of sample OWPP

St ¼¼: Wt of Residue in Supernatanto WP -2 100 Wt of Sample OWpP

Where W2 is the weight of the sample

2.4.3 Water Absorption Capacity

The water absorption method (WAC) of the UPF was determined as described by Oyeyinka et al. (2013) with a few modifications. Flour sample of 1g was weighed into a clean pre-weighed driedcentrifuge tube and mixed adequately with 10 ml distilled water by vortexing after which the suspension was allowed to stand for 30 min and centrifuged (Thelco GLC- 1,60647: Chicago, USA) at 3,500 rpm for 30 min. The supematant was decanted afici centrifugation, with the tube and, the sediment weighed. The weight of water (g) retained in the sample was reported as WAC.

2.4.4 Oil Absorption Capacity

Flour sample (1 g) was suspended in 5 ml of vegetable oil in a centrifugal tube, after which the slurry was shaken on a platform tube rocker for 1 min at room temperature and centrifuged at 3000 rpm for 10 min. The supernatant was decanted and discarded. The adhering drops of oil were removed and reweighed. The oil absorption capacity (OAC) was expressed as the weight of the sediment/initial weight of the sample (g/g) (Niba et al.,2001)

2.4.5 Dispensability

The method reported by Kulkarni et al. (1991) was used for the determination of the dispersibility. About 10 g of the sample was dispersed in a measuring cylinder (100 ml), and distilled water was added up to the 50 ml mark. The mixture was stirred vigorously and allowed to settle for 3 h. The volume of settled particles was noted, and the percentage of dispersibility was calculated as:

Dispensability 03% P ¼ OSO-Volume of the settled parti Cho = 100 50

2.4.6 Pasting Properties

The pasting properties of the plantain flours were determined using a Rapid Visco Analyser, RVA (Model RVA 4500, Perten Instrument, and Australia) equipped with a 1000 cmg sensitivity car- tridge. Plantain flour (3.5 g) was weighed into a dried empty canister, alter which 25 ml of distilled water was added. The mixture was thoroughly stirred, and the canister was fitted into the RVA. The slurry was heated from 50 to 95 °C at a rate of 1.5 °C/min., and held at this temperature for 15 min, cooled to 50 °C. Viscosity profile indices recorded were peak viscosity, trough, breakdown, final viscosity, setback, peak time. and pasting temperature was read from the pasting profile using a Thermocline for Windows Software connected to a computer (Falade & Olugbuyi, 2010).

2.4.7 Preparation of Plantain Amala for Sensory Evaluation

The UPF was made into Amala using the method described by Awoyale et al. (Awoyale et al.,2020). One part of the flour was mixed with approximately 1.5 parts of boiling water (v/v) in a stainless- steel pot. The paste was heated (with stirring for 5 min), using an electric cooker set at medium temperature until it is properly cooked. The Amala was allowed to cool to between 40 to 45 °C in a food flask, and scooped adequately with a spoon for evaluation. The sensory evaluation of the Amala was carried out using twelve trained panelists from the staff and graduate students of the International Institute of Tropical Agriculture (ITA), Nigeria.

They panelist were selected on the basis of their being conversant with eating of plantain Amala regularly, interest, availability and ability to articulate. A pre-screening exercise was done in which the panelist were screened for normal sensory acuity through basic taste test using solutions of sucrose (sweetness), sodium chloride (saltiness), citric acid (sourness) and quinine sulphate (bitterness), an odour recognition test and an intensity ranking tests as described by Watts et al. (1989). Panelist's sensitivity, which is their ability to discriminate between levels of particular sensory characteristics.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

A research method as a systematic plan for doing research. The different research methods used in this research are:-

1. **The Experiment:-** An experiment is a research method for investigating cause and effect under highly controlled condition. A hypothesis is a statement of how two or more variables are related. For this research work, we carry out experiment by using unripe plantain to produce amala and porridge for the treatment of diabetes.

2. **Survey Research:-** A survey is a research method in which subjects respond to series of statement or questions in a questionnaire or an interview survey targets some population, which are the people who are the focus of research. The survey of this research and population sample will be the lecturer and student of hospitality management department of Kwara state polytechnic to make analysis on the process of amala and porridge using unripe plantain

3. **Participant Observation:-** The most widely used strategy for collecting qualitative data is participant observation. Data will be collected through questionnaire given to the observer of product or Amala and porridge made from unripe plantain will be analyzed in the next chapter.

3.1 Research Design

A descriptive and analytical research design is used to establish the utilization of whole unripe plantain for production of Amala and Porridge in the treatment of diabetic. It is the blueprint for conducting the study that maximizes control over factors that could interfere with the validity of the findings. Designing a study helps the researcher to plan and implement of this study in a way that will help in researcher to obtain intended results, thus increasing the chances of obtaining information that could be associated with the real situation of stock management.

3.2 Study Area

This study was carried out in kwara polytechnic llorin, lorin is the present day capital of K wara state in the north central region of the federal republic of Nigeria. It is a predominantly Islamic city with people of diverse culture who have come together live as one in peace and harmony. It was real carried out in hospitability department.

3.3 Target Population

The population for the study comprised of staff of Kwara State Polytechnic (100) respondents including senior and junior in the organization. Questions are asked using questionnaire as the research instrument and the questions asked are based on the topic of the research work so as to keep within the scope of the study and also ensure the validity of the data gathered and ultimately answer the research questions asked in chapter one.

3.4 Sampling Techniques

This is otherwise known as population of the study and it can be define as including all the people or items with the characteristic, one wish to understand. Because there is rarely enough time or gather information from everyone or gathering in a population, the goals become linding a representative sample (or subject) of that population. The total population at the study to be 100 in Kwara State Polytechnic Ilorin.

3.5 Sampling Sizes

The aim of sampling is to analysis data collected and prepare them. Data itself was extracted mainly through the application of the self-administered questionnaire to the inhabitance of the study area.

A total of one hundred (100) questionnaires were administered out of which one hundred (100) were filled and return. The data obtained from these questionnaires were analysis in form of table, bar chart and pie chart, percentage elc.

3.6 Research Instrument

Questionnaires

This method involves preparation of question which is asked through printed pages. Data were collected on both the household and individual level.

3.7 Self Completed Questionnaires

It was completed through Primary and Second Questionnaires

This questionnaire is a data collection tool in which written questions are presented that are to be answered by the respondents in written form.

3.8 Data Collection Techniques

The information was obtained by reading the company's inventory records. including: manuals, purchasing procedures, stock control process, storage systems, issuing and receiving documentation.

3.9 Method of Data Analysis

The findings are presented in quantitative forms where they are discussed, described and interpreted systematically in relation to the objectives of the study. Data is analyzed by making references to the available documents and literature, in order to compare and contrast different opinions as presented by the different methods of inventory management. The aim is to identify the gaps that exist in order to make appropriate recommendations.

CHAPTER FOUR

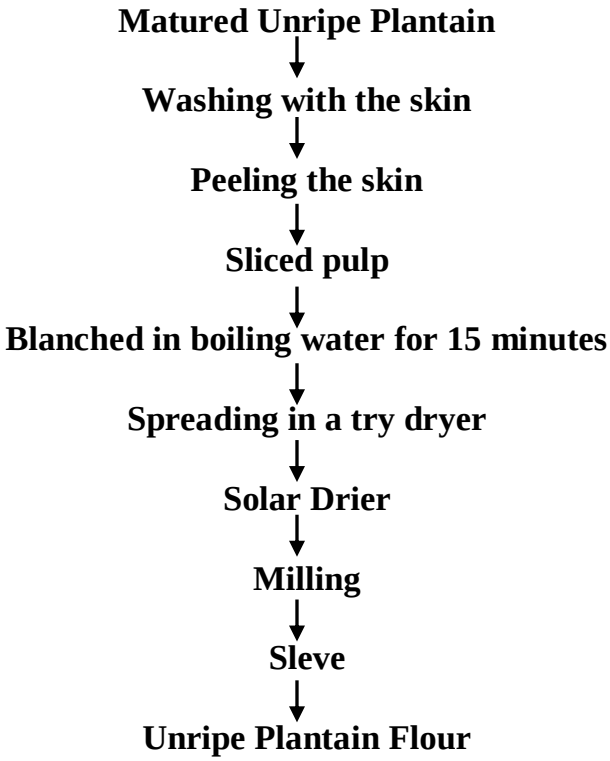
PRESENTATION AND ANALYSIS OF DATA

4.1 Introduction

This Chapter is meant to present the Amala and Porridge production process and analysis of data collected for the study.

In order to provide appropriate statistical result of the data collected through sensory evaluation of the Amala and Porridge production, the following tables would be used to discuss the analysis.

The flow Chart of Amala and Porridge Production



4.2 Data Presentation

In this chapter all a data collected from questionnaires will be presented and interpreted

Table 4.2.1: Questionnaire Distribution and Collection

Number of Questionnaire Distributed	100
Number of Questionnaire Returned	100
Number Of Questionnaire Not Returned	0

Source: Field Survey, 2022

From the above analysis, the research will be making use of the number of questionnaire which is 100

Table 4.2.2: Distribution of the Respondents by Gender

VARIABLE	NUMBER OF RESPONDENTS	PERCENTAGE (%)
Male	60	60%
Female	40	40%
Total	100	100%

Source: Research Survey, 2022

The table above show 60 (60%) of the respondents are Male, while 40 (40%) are Female

Table 4.2.3: Distribution of the Respondents by Age

VARIABLE	NUMBER OF RESPONDENTS	PERCENTAGE (%)
18-25year	30	30%
26-30years	40	40%
36-45years	30	30%
46 and Above		
Total	100	100%

Source: Research Survey, 2022

The Table shows that 30 (30%) of the respondents are of age 18-25years, While 40 (40%) of the respondents are of age 26-35years while 30 (30%) of the respondents are of age 36-45years.

Table 4.2.4: Distribution of the Respondents by Religion

VARIABLE	NUMBER OF RESPONDENTS	PERCENTAGE (%)
Islam	60	60%
Christianity	40	40%
Others		
Total	100	100%

Source: Research Survey, 2022

The Table above shows that 60 (60%) of the respondents are Muslims, While 40 (40%) of the respondents are Christians.

Table 4.2.5: Distribution of the Respondents by Marital Status

VARIABLE	NUMBER OF RESPONDENTS	PERCENTAGE (%)
Single	60	60%
Married	40	40%
Divorced		
Total	100	100%

Source: Research Survey, 2022

The Table shows that 60 (60%) of the Respondents are Single while 40 (40%) of the Respondents are Married.

Table 4.2.6: Distribution of the Respondents by Education Qualification

VARIABLE	NUMBER OF RESPONDENTS	PERCENTAGE (%)
SSCE	25	25%
NCE/OND	50	50%
BSC/HND	25	25%
Others		
Total	100	100%

Source: Research Survey, 2022

The Table shows that 255 (25%) of the Respondents are SSCE Certificate Holders, while 50 (50%) of the Respondents are NCE/OND, while 25 (25%) of the Respondents are BSC/HND Holder.

Table 4.2.7: What are the Method of Create Awareness of Unripe Plantain with the use of Mechanized Equipment?

VARIABLE	NUMBER OF RESPONDENTS	PERCENTAGE (%)
Bioyield Strength	30	30%
Bioyield Strain	20	20%
Required Strength	30	30%
Rapture Strain	20	20%
Total	100	100%

Source: Research Survey, 2022

The Table above shows that 30 (30%) Respondents say Bioyield Strength, 20 (20%) Respondents Say Bioyield Strain, 30 (30%) Respondents Say Rapture Strain Strength, 20 (20%) Respondents say Rapture Strain.

Table 4.2.8: What is the best Soup to eat Unripe Plantain Flour (Amala)?

VARIABLE	NUMBER OF RESPONDENTS	PERCENTAGE (%)
Jute Leaf (Ewedu)	29	329%
Vegetable (Efo)	24	24%
Egusi	20	20%
Ogbono	23	23%
Total	100	100%

Source: Research Survey, 2022

From the Table above analysis, it can be seen that 29 Respondents Representing 29% Jute Leaf, 24 Respondents Representing 24% is Vegetable, 20 Respondents Representing 20% is Egusi, 23 Respondents Representing 23% is Ogbono

Table 4.2.9: What does Unripe Plantain Flour do to the Body?

VARIABLE	NUMBER OF RESPONDENTS	PERCENTAGE (%)
Excellent Diabetic Food	40	40%
Maintains Blood Pressure Control	20	20%
Helps with weight loss	30	30%
It can stop ulcers	20	20%
Total	100	100%

Source: Research Survey, 2022

From the Table above analysis, it can be seen that 40 Respondents Representing 40% Excellent Diabetic Food, 20 Respondents Representing 20% is Maintains blood pressure control, 20 Respondents Representing 20% is Helps with weight loss, 20 Respondents Representing 20% is it can stops ulcers.

Table 4.2.10: The Demand of Unripe Plantain Flour has Tremendously?

VARIABLE	NUMBER OF RESPONDENTS	PERCENTAGE (%)
Health Benefit	35	35%
For Diabetic Patient	45	45%
Daily Food	20	20%
Total	100	100%

Source: Research Survey, 2022

From the Table above analysis, it can be seen that 35 Respondents Representing35%, Health Benefit, 45 Respondents Representing 45% is for Diabetic Patient while 20 Respondents Representing 20% is Daily Food.

Table 4.2.11: Does Unripe Plantain Flour is Good for the Production of Amala and Porridge the Treatment of Diabetic ?

OPTIONS	NUMBER OF RESPONDENTS	PERCENTAGE (%)
Strongly Agree	72	72%
Agree	18	18%
Disagree	5	5%
Strongly Disagree	5	5%
Total	100	100%

Source: Research Survey, 2022

From the Table above it shows that 72 Respondents Representing 72% Strongly Agree that Unripe Plantain Flour is good for the production of Amala and Porridge for the Treatment of Diabetic, 18 Respondents Representing 18% Agree, 5 Respondents Representing 5% said that they Disagree while 5 Respondents Representing 5% Strongly Disagree.

Table 4.2.12: Does Amala and Porridge is really curing Diabetic?

OPTIONS	NUMBER OF RESPONDENTS	PERCENTAGE (%)
Strongly Agree	51	51%
Agree	37	37%
Disagree	10	20%
Strongly Disagree	2	2%
Total	100	100%

Source: Research Survey, 2022

From the above shows that 51% Representing 51 Respondents Strongly Agree that Amala and Porridge is good for non diabetic patient, 37% Representing 37 Respondents Agree. 10% Representing 10 Respondents said that they Disagree while 2% Representing 2 Respondent said that they Strongly Disagree.

Table 4.2.14: Unripe Plantain Flour for the Production of Amala and Porridge is good for daily food?

OPTIONS	NUMBER OF RESPONDENTS	PERCENTAGE (%)
Strongly Agree	40	40%
Agree	36	36%
Disagree	5	5%
Strongly Disagree	5	5%
Total	100	100%

Source: Research Survey, 2022

The Table above shows that 40% Representing 40 Respondents Strongly Agree that Unripe Plantain Flour for the production of Amala and porridge is good for daily food, 36% Representing 36% Respondents said that they agree, 19% Representing 19 Respondents choose Disagree while 5% Representing 5 Respondents Strongly Disagree.

Table 4.2.15: Does Unripe Plantain Good for Health Improvement?

OPTIONS	NUMBER OF RESPONDENTS	PERCENTAGE (%)
Strongly Agree	40	40%
Agree	36	36%
Disagree	19	19%
Strongly Disagree	5	5%
Total	100	100%

Source: Research Survey, 2022

The Table above shows that 40% Representing 40 Respondents Strongly Agree that Unripe Plantain Flour good for health improvement, 36% Representing 36% Respondents said that they agree, 19% Representing 19 Respondents choose Disagree while 5% Representing 5 Respondents Strongly Disagree.

Table 4.2.16: Adding of Ripe Plantain with Unripe Plantain when Producing Plantain Porridge Does it have any effect on the Diabetic Patient?

OPTIONS	NUMBER OF RESPONDENTS	PERCENTAGE (%)
Strongly Agree	51	51%
Agree	37	37%
Disagree	10	10%
Strongly Disagree	2	2%
Total	100	100%

Source: Research Survey, 2022

The Table above shows that 51% Representing 51 Respondents Strongly Agree that Adding of Ripe Plantain with Unripe Plantain when producing Plantain porridge does it have any effect on the diabetic patient, 37% Representing 36% Respondents said that they agree, 10% Representing 19 Respondents choose Disagree while 2% Representing 5 Respondents Strongly Disagree.

Table 4.2.17: Can Unripe Plantain Get Spoiled if not correctly Processing, Package and Store?

OPTIONS	NUMBER OF RESPONDENTS	PERCENTAGE (%)
Strongly Agree	40	40%
Agree	36	36%
Disagree	19	19%
Strongly Disagree	5	5%
Total	100	100%

Source: Research Survey, 2022

The Table above shows that 40% Representing 40 Respondents Strongly Agree that Can Unripe Plantain Get Spoiled if not correctly Processing, Package and Store, 36% Representing 36% Respondents said that they agree, 19% Representing 19 Respondents choose Disagree while 5% Representing 5 Respondents Strongly Disagree.

4.3 Sensory Evaluation

Comparison of Sample Texture, Colour, Odour and Taste Table Sample A (Amala Production)

Evaluation	Excellent	V. Good	Good	Fair	Poor	Total
Texture	-	-	40	60	-	100%
Color	-	-	60	40	-	100%
Odor	-	-	50	50	-	100%
Taste	-	30	40	30	-	100%
%	0.0%	7.5%	47.7%	45.0%	0%	

From the above Table, 40 Respondents said the Texture is good, 60 Respondents said is fair while 60 Respondents said the color is good, 40 said the color is fair, 50 Respondent said the odor is good while 50 Respondents said the odor is fair, and 30 Respondent said the Taste is very good, 40 Respondent said is good, 30 Respondents said the taste if fair.

Sample A (Porridge)

Evaluation	Excellent	V. Good	Good	Fair	Poor	Total
Texture	20	20	40	20	-	100%
Color	-	10	80	10	-	100%
Odor	-	-	30	70	-	100%
Taste	-	20	70	10	-	100%
%	05%	12.5%	55.0%	27.5%	0%	

From the above Table, 20 Respondents said the Texture is Excellent, 20 Respondents said is Very Good while 40 Respondents said the Texture is good, while 20 Respondents said the Texture is fair. One Respondent said the color is very good, eight respondents said is good, One respondent said is fair.

Three Respondents said the odor is good, seven Respondents said is fair, two Respondents said the taste is very good, seven Respondents said is good, one Respondents said the taste is fair.

Sample C (Equal Proportion of Amala and Porridge)

Evaluation	Excellent	V. Good	Good	Fair	Poor	Total
Texture	-	30	40	30	-	100%
Color	10	30	50	10	-	100%
Odor	-	-	20	70	10	100%
Taste	-	40	60	-	-	100%
%	2.5%	25%	42.5%	27.5%	2.5%	

From the above Table Three Respondents said the Texture is very good, four respondents said is good, Three respondents said is fair.

One Respondent said the color is excellent, three respondents said is very good, five Respondent said is good, One respondent said is fair.

One Respondent said the odor is good, seven respondents said is fair, one respondent said is poor.

Four Respondents said the taste is very good , six respondents said the taste is good

CHAPTER FIVE

SUMMARY, RECOMMENDATION AND CONCLUSION

5.1 Summary

Amala and Porridge productions from unripe plantain. This topic was selected by the researcher to experiment the result of Amala and porridge produce from unripe plantain in the treatment of diabetic.

Unripe plantain were bought from the market (pata market, lorin) and it was euf dry and blend The unripe plantain were blended and addictives were added to get the production of A mala and porridge. Sensory evaluation was carried out on the on both Amala and porridge produced, and the result were analyzed and presented in chapter four.

5.2 Recommendations.

i. There are many unripe plantain in the market used for chips, plantain flour and other purposes.

ii. Various methods of extraction should be carried out on these unripe plantain flour to enhance their production.

iii. For anyone that will be researching more on this topic proper consideration should be given to Amala and porridge on how to suppress the odour to give output on the production.

iv. Improvement should also be made on the method of using unripe plantain to produce Amala and porridge, the Amala and porridge produce can therefore be used for the treatment of diabetic and other purpose.

5.3 Conclusion

Amala and porridge production from unripe plantain flour was achieved after the unripe plantain were blended together and addictives added.

The Amala and porridge have various moisture content, yield and the unripe plantain were cut dry for the process.

unripe plantain were used in different production both Amala and porridge. For the production of Amala, it was cut dry and blend to become unripe flour before it was used for the production of Amala. The second product (porridge) the unripe plantain were cut, mixed it with some indigent and cooking before it turn to the porridge which is good for healthy living.

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QUESTIONNAIRE

KWARA STATE POLYTECHNIC, ILORIN INSTITUTE OF APPLIED SCIENCES HOSPITALITY DEPARTMENT

Dear Respondent,

We are under graduate of the above mentioned institution carrying out a research on "UTILIZATION OF WHOLE UNRIPE PLANTAIN FOR THE PRODUCTION OF AMALA AND PORRIDGE IN THE TREATMENT OF DIABETIC". Your responses are needed and all information supplied shall be used mainly for academic and education purposes only.

Thanks.

Section A

INSTITUTION:- Please tick (v) as applicable to you

Gender: (a) Male ( ) (b) Female ( )

1. Age: (a) 18-25 ( ) (b) 26-35 ( ) (c) 36-45 ( ) (d) and above ( ).

2. Religion: (a) Islam ( ) (b) Christianity ( ) (c) Others ( ).

3. Marital Status: (a) Single ( ) (b) Married ( ) (c) Divorced ( )

4. Educational background: (a) SSCE ( ) (b) NCE/OND ( ) (c)BSC/HND ( )

(d) Others ( ).

KEYS: Strongly agree (SA), Agree (A), Disagree (D) Strongly Disagree (SD).

Section B

What are the method of create awareness on unripe plantain with the use of mechanized equipment? (a) Bioyield strength ( ) (b) Bioyield strain ( )

(c) Rapture strength ( ) (d) Rapture strain ( )

What is the best soup to eat unripe plantain flour (Amala) (a) Jute Leaf (Ewedu) ( )(b) Vegetable (Efo) (c) Egusi ( ) (d) Ogbono ( ).

What does unripe plantain do to the body (a) Excellent diabetic food ( ) (b) Maintains blood pressure control (c) Helps With Weight Loss (d) It Can Stop Ulcers ( ). the demand of unripe plantain flour has tremendously? (a) Health benefit (b) for diabetic patient (c) Daily food ( )

Does unripe plantain flour is good for the production of Amala and porridge for the treatment of diabetic (a) Strongly Agree ( ) (b) Agree ( ) (c) Disagree ( ) (d) Strongly Disagree ( ).

Does Amala and porridge is really cure diabetic (a) Strongly Agree ( ) (b) Agree ( )(c) Disagree ( ) (d) Strongly Disagree ( ).

Does Amala and porridge is good for non diabetic patient? (a) Strongly Agree ( ) (b) Agree ( ) (c) Disagree ( ) (d) Strongly Disagree ( ).

Unripe plantain flour for the production of Amala and Porridge is good for daily food (a) Strongly Agree ( ) (b) Agree ( ) (c) Disagree ( ) (d) Strongly Disagree ( ).

Does unripe plantain good for health improvement? (a) Strongly Agree ( ) (b) Agree ( ) (c) Disagree ( ) (d) Strongly Disagree ( ).

Adding of ripe plantain with unripe plantain when producing plantain porridge does it have any effect on the diabetic patient? (a) Strongly Agree ( ) (b) Agree ( ) (c) Disagree ( ) (d) Strongly Disagree (.)

Can unripe plantain get spoil if not correctly processing, package and store? (a) Strongly Agree ( ) (b) Agree ( ) (c) Disagree ( ) (d) Strongly Disagree ( ).