UTILIZATION OF CASSAVA IN PRODUCTION OF INSTANT FUFU

BY

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CERTIFICATION

This project work has been examined and approved as meeting the requirements of Department of Hospitality Management, Institute of Applied Science, Kwara State Polytechnic, Ilorin, Kwara State. In Partial Fulfilment of the Requirement for the Award of National Diploma (ND) in Hospitality Management.

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DEDICATION

I dedicate my studies to the almighty God, who has been my guide, saviour, provider and refuge may his wisdom never depart from me throughout my academic journey. Amen

Also, I dedicate this to my lovely and supportive father MR. JOLAYEMI NUSIRUDEEN, for his support and words of encouragement and I promise to make you proud

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May almighty Allah grant all your wishes.

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CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

In Nigeria, there have been several attempts at overcoming the nutritional value of cassava base diets by fortifying with soya bean, which has high protein contents of good quality. Cassava supplies about 70% of the daily calorie of over 50million people in Nigeria (Akubor and Ukwuru, 2003). It is essentially a carbohydrate food with low protein, fat, essential minerals and vitamin content (Anyankunbi *et al.,* 1991). Cassava root also contains large amount of toxic cyanogenic glycosides (linamarin and lotaustralin) which are hydrolyzed by linamarase to hydrocyanic acid (HCN) when the plant tissue is damaged during harvesting and processing (Yeoh *et al.,* 1996, Oyetoro, 2013). Cassava roots are processed by various methods into various products that vary with local customs and preferences. Such products include flour, garri, lafun, fufu, pupuru, akara etc. details and methods of preparation these products vary and this greatly affects the quality of the finished products. Cassava product are consumed as staple foods in most states of Nigeria where cassava is grown. Fufu is a thick paste made by boiling flour in water, stirring vigorously with a wooden paddle until a desired consistency is formed.

Fufu flour could be prepared from cassava, yam, potatoes, cocoyam, cereals etc. the composition of fufu depends on the raw material used for its preparation. Cassava fufu is widely consumed in all the parts of Nigeria, and it is the most popular fufu product (Akubor and Ukwuru, 2003). The methods for the preparation of cassava flour that is used for making cassava fufu vary widely.

1.2 Statement of the Problem

The major problem associated with utilization of cassava in the production of instant fufu:

- Low level of knowledge of local farmers on improved production methods
- Limitation imposed by lack of high-level production inputs
- Poor pricing of agricultural products
- Local farmers lack of access to credit facilities
- Poor infrastructural facilities that could facilitate processing and storage.

These problems limit the capacity of the domestic markets in meeting the industrial demand for cassava and implications for its development in Nigeria. Industrial consumers therefore consider these limitations in the production.

1.3 Aims and Objectives

To design a utilization of cassava in the production of instant fufu, for the increasement of food in the food services establishment.

- To increase the cassava factory production
- To identify the nutritional value of instant fufu to the consumer
- To increase varieties of menu

1.4 Significance of the Study

This research work is useful to the practitioners in hospitality industry, caterers and health workers.

This project work is also good to the society at large and anybody who lay hands on this project as they can learn on how the utilization of cassava in the production of instant fufu is done.

In order to take Nigeria to her glorious past, when agriculture was the backbone of the economy and to diversify economy, the federal Government has advised the citizen to go back and till the ground (i.e. farming) in order to exploit the abundant agricultural resources lying fallow in the country such as soya and cassava and set up processing factories.

1.5 Scope and Limitation of the Research

The research work finding will be limited to some special soya in hospitality industry. It could have been a wider coverage but due to the time and financial constraints. The study will focus on some types of the utilization of cassava in the production of instant fufu.

1.6 Definition of Terms

Evaluation of the raw materials: water and cassava tuber that the plant needs for the smooth running of the factory.

- ✓ Acquisition of splendid ideas about site planning requirements
- ✓ Acquisition of adequate site selection criteria
- ✓ Acquisition of amount and cost of energy required for the smooth running of the factory
- ✓ Atomizer: a device for production fine droplets of liquid. Usually either a high-pressure nozzle or a perforated spinning disk through which the liquid is pumped.

- ✓ Cyclone: A device for separating air and powder particles
- ✓ Effect: A single unit in an evaporator operating at a particular pressure and temperature. Evaporators commonly have three to seven effects to allow heat to be re-used several times.
- ✓ Fluid bed: A piece of equipment used for drying or cooling milk powder
- ✓ Air is blown through the powder from below causing the powder particles to separate and behave rather like a fluid. Alternatively, a layer of fluid like powder in which the particles are kept apart by an air flow
- ✓ Recombined: liquid milk or other 'fresh' product made by mixing skin milk powder, milk fat, water and possibly other components
- ✓ Reconstituted: liquid milk or other 'fresh' product made by mixing milk powder and water
- ✓ Rheology: the branch of physics that studies the deformation and flow of matter
- ✓ Farinograph: a recording dough mixer designed to measure qualitatively and record automatically the dough-forming properties of different wheats under controlled conditions of temperature
- ✓ Extensograph: measures flour quality and the dough stretch ability. An extensograph is a tool used for measuring the flour quality and stretching behaviour of dough.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The problem of malnutrition as a result of vitamin A deficiency in the developing countries has been a challenge (Mayer, Pfeiffer and Beyer, 2008). Millions of people in the world not minding the vulnerable group now get fewer vitamins than what is needed in the diet.

Wild populations of M. esculenta subspecies flabellifolia, known to be the progenitor of domesticated cassava, are centered in west-central Brazil. Manioc pollen appears in the Gulf of Mexico lowlands, at the San Andres archaeological site. Exactly where is not known, but the current consensus is that domestication took place somewhere in central or south America, perhaps along the southern border of Brazil, where wild relatives of cassava are currently found. The Amerindians living in this area were the Tupinamba, who relied on cassava as a dietary staple, processing it into bread and meal using techniques similar to those used by Americans in the twenty-first century.

The Portuguese used cassava in the form of meal (farinha) as provision in their ships when they began to import slaves from Africa in about 1550, cultivating cassava at their stations along the coast of west Africa soon afterward. From their stations near the mouth of the Congo River, cassava diffused to all of central Africa. The Portuguese were also responsible for introducing cassava to Wast Africa, Madagascar, India, Ceylon, Malaya and Indonesia by the 1700s. cassava is typically grown by small-scale farmers using traditional methods, and farming on marginal lands not well suited to other crops. Mechanical harvesting is still relatively rare.

The processing of cassava to different cassava food products cannot be actually attributed to a certain region of the world as the case may be but it was evident that the earliest form of cassava tuber conversion to eatable stable food products emerges from southern American regions of the world where it was early discovered.

Cassava roots deteriorate rapidly (within three to four days) after harvesting and usually consumed immediately. This set back in the preservation of the consumable food products derived from the processing of cassava root tuber gives birth to different innovative means by wish the shelf life of these variants of products can be increased and improved, thereby being processed into a form that has better storage characteristics. Fresh roots (low-cyanide) destined for distant markets can be sealed in wax, packaged in plastic bags, or frozen to prevent deterioration.

Cassava is processed into different food products, but the one which attracts most attention apart from Garri is the dried powered fufu flour because of the processes involved in its processing which includes various strategies for scaling up the fufu business studied through sourcing and testing for appropriate drying system and answers to the changing habits of consumers and the current wave of urbanization coupled with the need for promotion of commercialization of traditional foods like cassava products, hence its been tagged from findings that its one of the most potential small-scale project innovative business in the food production industry that spins money using always available raw materials and easy to acquire production technology.

The recent introduction of yellow root cassava or B carotene cassava varieties have potential of providing up to 25% of daily vitamin A required by the body thereby improves the nutritional status of the consumers.

Therefore, there is a need to evaluate some of the foods that consumers eat every-day from these newly bread crops for value addition as well as enhancing better and wide range utilization of the crop (Mayer *et al.,* 2008).

2.2 The Use of the Starch

Produced from biofortified cassava roots in the production of custard powder which has gradually find its application in food formulation and composite flour preparations in Nigeria would be one of the sustainable strategic to prevent and minimize the deficiency of vitamin A. custard powder is an edible yellow colour starch, sweetened and flavour in which when hot milk is added, the gruel gives and desired colour, taste and aroma (Okoye, 2017). The addition of animal protein egg can also serve as a source of protein in custard production (Awoyale, Sanni, Shittu & Adegunwa, 2015).

However, as a result of financial situation of the populance, many consumes custard without adding milk or eggs which result in dietary deficiencies of protein and this has been another growing nutritional problem in Nigeria. Many people have been implicated in malnutrition (Akoja & Mohammed, 2011). Therefore, protein supplementation of cassava-based products is essential.

2.3 The Cassava Plant

Cassava is grown primarily for its enlarged storage roots, which are used for human consumption, following a variety of traditional processing methods including boiling, roasting, processing into flour and fermentation (Salick, Cellinese and Knapp, 1997; Hillocks, 2002). Although cassava has the lowest protein-to-carbohydrate ratio among major crops (Sayre *et al.,* 2011), it plays an important dietary role in the diets of almost 1 billion people worldwide (Prochnik *et al.,* 2012).

In some regions, particularly in Africa and Brazil, the foliage may also be harvested for human consumption and animal feed, providing supplemental dietary protein (Hillocks, 2002). Cassava is also grown for industrial purposes, such as the production of starch and for fermentation into ethanol (El-Sharkawy, 2004; Adelekan, 2010). Analyses of the susceptibility of crops to the impacts of climate change indicate that cassava may be better suited to survive climatic variations than most major tropical staple crops, which would make it a key food security crop for the future. However, while calculations indicate that cassava has the potential to produce and store more carbohydrate than any other major grain or root crop, it typically fails to reach that potential due to poor-quality planting material, sub-optimum agronomic practices and disease and insect pests (El-Sharkawy, 2004; Fermont *et al.,* 2009; jarvis *et al.,* 2012).

The roots and leaves of cassava and other Manihot species are known to release Hydrogen Cyanide (HCN), which can be toxic to humans and animals when consumed, although the incidence of cyanide poisoning is rare (OECD, 2009). Cassava varieties are classified as 'bitter' (glucoside content >100mg/kg fresh wt) or 'sweet' (glucoside content >100mg/kg fresh wt) according to their level of HCN production (Alves, 2002; peroni, Kageyama and Begossi, 2007). Cassava breeding programmes actively select for varieties which produce lower levels of HCN (Janick and Byrne, 1984), but some farmers favor cassava with a high cyanide content due to the belief that such varieties are more insect and stress resistant and less prone to theft by humans and predation by mammals (Janick and Byrne, 1984; Fregene and Puonti-Kaerlas, 2002, Lebot, 2009). Most traditional processing methods of cassava enable the safe dissipation of any HCN produced by the plant and industrial

processing methods also remove HCN; however, when large amounts of cassava are processed, toxic effluents can be generated (Taylor *et al.,* 2004).

The food and feed processing and use of cassava are described in the "Consensus document on compositional considerations for new varieties of cassava" (OECD, 2009). HCN is released through the hydrolysis of two cyanogenic glycosides, primarily linamarin, with lower levels of lotaustralin, and hydrolysis is initiated by physical disruption of plant tissues. Linamarin is hydrolysed by linamarase to release HCN. Linamarin is contained in the vacuoles of intact plant cells, while linamarase is located in the cell walls. Tissue disruption allows the two compounds to react (Alves, 2002).

2.4 Cassava Production in Nigeria

Nigeria is the world's largest cassava producer; its cassava transformation is the most advanced in Africa. However, the scope for increasing the use of cassava in Nigeria's industries is, to a large extent, determined by the development of an efficient and well-integrated production and marketing system, to assure a steady supply of cassava products of stable, high-quality standards and appropriate price and of specific properties required by domestic industries and export markets. Thus, public and private investments in research and development required to develop cassava products for industrial uses, if well targeted, could offer good returns and prospects for the future of cassava in Nigeria.

The belief that a growing demand for cassava will spur rural industrial development and contribute to the economic development of producing, processing and trading communities and well-being of numerous disadvantaged people in the world, has prompted the development of the global cassava development strategy.

The strategy was endorsed at the international validation forum jointly organized by the food and agriculture organization of the United Nations (FAO) and the international fund for agriculture development (IFAD) held in Rome, Italy in April 2000. It suggests that industry analysis in cassava-producing countries should be undertaken to indicate current status strengths, weaknesses and issues for attention and action needed to resolve pressing constraints and take advantage of markets and business opportunities as well as to encompass finding of committed national champions.

The study on "A cassava industrial revolution in Nigeria" coordinated by the international institute of tropical agriculture (IITA) is in line with the global cassava strategy. It was prepared as a contribution to the joint effort by IITA and the federal Government of Nigeria to enhance the Nigeria cassava industry. This has been followed-up with similar support from many of the petroleum and crude oil producing companies operating in Nigeria to ensure that this effort is achieved.

As part of the study, a nationwide cassava industry analysis was commissioned to DTP studies inc. of Canada to determine the actual and potential size of the market for cassava and cassava-based products in Nigeria and to assess what is required in terms of economic, social and physical investments to develop an efficient cassava industrial sector. The study team comprising of agricultural Economists format studies inc., a local post harvest specialist and an agronomist began work in November 2003 with an extensive search for available data on the Nigeria cassava industry. This involved visits by the study team to all state agricultural development programmes (ADPs), federal offices and key industrial informants. Duplication was minimized by not visiting those industries already visited by previous consultants, instead information from their reports was used.

This report together with the resulting statistical handbook forms a pool of information from which private sector investor information can be drawn. It is obvious that in its current form, the information contained in this report may be too detailed to interest large, medium and small-Scale investors. Condensed reports and pamphlets for industrial application should be gleamed from this report to suit specific end user interests.

2.5 Cassava Utilization and Pricing

Cassava is sometimes classified as a crop for developing countries and for consumption only by rural people, whereas the large crop of cassava grown annually in the tropics is actually consumed in all its forms at nearly all income levels. Originally the cassava tuber was a main food crop only in South America. Nowadays, however, it is grown as a substitute for rice or alternately with rice on extensive acreages in regions where, for centuries, rice has been sole food crop.

In many tropical countries cassava as the principal source of carbohydrates occupies much the same position in the diet as potatoes in parts of the temperate zones. The cassava tuber is not a balanced food, consisting as it does largely of starch (Table 10); nonetheless, it is the most remunerative of crop plants in the hot climates, yielding perhaps more starch per hectare than any other cultivated crop with a minimum of labour.

During the second world war, cassava assumed tremendous importance as a famine crop in many parts of the world, especially when rice supplies were cut off. Leaves and lender shoots are used in many tropical areas as a cooked vegetable or in sauces, as they are rich in vitamins and have a high protein count.

RAW AND COOKED CASAVA FOR IMMEDIATE CONSUMPTION

In the raw state the roots of the sweet varieties are used as forage without being peeled. In the Philippines their suitability in hog feeding has been amply demonstrated in experiments.

The fresh, peeled root of the same varieties is suitable for human consumption, provided it is no more than a few months old, but it is seldom used as such. It cannot be kept for more than a day. The roots of the sweetest varieties are sometimes eaten raw as a between-meals snack or thirst quencher.

With simple cooking the root becomes equivalent to potatoes, though its taste is considered 'heavier' prussic acid in the fresh root is destroyed by slowly cooking the sliced roots, starting with ample cold water so that gradual heating ensures hydrolysis of the toxic principle. If the roots are submitted to fierce heat, thereby destroying enzyme action, a possibility of the retention of bound prussic acid exists, which in the bitter varieties may be dangerous. With the same reservation, steaming and especially frying in oil are recommended, as both these methods produce palatable foods.

In Indonesia, roots are often wrapped in leaves after covering them with a yeast preparation, fermentation for 24hours suffices to produce a soft and slightly alcoholic side dish.

Many food dishes using cassava, boiled or baked, as the basic ingredient to which is added meat, fish, soybean cake, shrimps or other protein source are prepared in various countries (e.g, Krubub, Ketela and fish or prawn crackers in the far East; Sancochado, Escabeche, Seco de Carnero, Sebiche and Pachananca in south America).

CONSERVED CASSAVA PRODUCTS

GAPLEK

The simplest method of conservation consists of drying the sliced root in the sun; in the tropics this takes two or three days. Once dry, gaplek is sufficiently durable; during drying however, it is particularly liable to mould, making it unsuitable for human consumption. Before the second world war, the milled product (gaplek meal) was an important export from Indonesia to Europe for animal fodder.

Gaplek meal find some application in those starch using industries where the high content of moulds, fibre, and other constituents of the whole root can raise no serious objection, as in textile finishing and the manufacture of alcohol. As it is easy to maintain a large stock of gaplek, there would therefore be obvious advantages in using it as a basic material for the production of pure cassava starch. In Indonesia this use has presented no serious technical difficulties; however, it has never been applied on an important scale.

FARINHA AND CASSAVA BREAD (COUAC)

A somewhat more elaborate treatment of the root than is needed for the production of gaplek leads to conservable food products which seem to be known only in Latin America and play an important role in nutrition there. It is interesting that this mode of preparation is usually combined with the traditional manufacture of crude cassava flour at the domestic level.

The roots, cleaned superficially, are first peeled with a knife and then grated. The most primitive garter, used by south American Indians, consists of a board upon which a number of little flints are embedded in a thin layer of wax. Graters

consisting of a wooden board with wooden teeth are also in use. In somewhat more developed areas this work is done with a rotating rasp, usually hand-driven, which does not differ very much from the raspers in rural mills elsewhere.

When a sufficient amount of the rasped material has been collected, it is packed in leaves and pressed under a heavy stone, sometimes with the aid of pole leverage, or in a wooden screw-press. The traditional instrument in Latin America for this purpose, however, is a basketwork cylinder known as the tipiti, which is specially woven so that it can take both a long and thin as well as a short and bulky form. In the latter form the basket is packed with fresh cassava pulp and hung from the bough of a tree, the 'sock' being pulled until it is long and thin. This operation subjects the pulp to considerable pressure, thus extracting the greater part of the possibly poisonous juice.

The pulp obtained may be worked in two ways. In the preparation of farinha it is mixed for better quality with a little pulp which has been left to ferment for three days. The whole is then pounded and rubbed through a sieve, producing a slightly damp meal.

It is then heated, in the open air, in a pan on a flat oven with a top consisting of granite slabs which guarantee even heat without burning. The pulp is turned continuously with a wooden rake during 3 to 4 hours of baking, which produces granular, only slightly roasted product. If dry, farinha will keep indefinitely. It is an excellent cereal, usually eaten like rice in combination with other foods, especially meat and gravy, but it is also very useful as an emergency ration for travellers. It is known as farinha de mandioca or farinha de mesa.

By heating the pulp more intensively, without stirring, until the mass is slightly brown on one side, it sets into a solid slab. After baking on both sides, the cakes are further dried in the sun, and in this state will keep indefinitely. This cassava bread, or couac, is very hard, but it has an excellent flavour: it is usually eaten after being dipped in gravy.

In rural factories producing farinha or couac, generally only part of the pressed cake of cassava pulp is worked up to produce these products. The rest, in portions, is washed out in a cloth above a wooden bowl, each portion being stirred with successive amounts of water until most of the starch has been extracted. The bowl containing the starch milk is put aside for settling. After some time, the water is decanted, and the starch spread in the sun on reed matting. In two days, it is dry. The flour obtained, of low to medium grade, is commonly used in Brazil for making cakes.

In Brazil also, the peeled roots are cut into large chunks and dried. The dried product is ground, sifted and the flour, known as farinha de raspa, is mixed with wheat flour in the making of bread, macaroni, crackers, etc.

GARRI

A popular food among the low-income groups in west Africa and Nigeria, it is made by fermenting grated cassava tubers, semi-dextrinizing the mash by heat and finally drying the product to a type of meal. In rural areas, the roots are peeled and grated, and the pulp is put into a large cloth bag and set in the sun to drain and to ferment. When the pulp is sufficiently dry, it is removed from the sack for final drying on a low fire. Fermentation liberates the hydrocyanic acid at low PH and develops the characteristic flavour of garri. It is carried out first by cassava bacteria

(Corynebacrerium Manihot) that attack the starch with the production of lactic and formic acids, and then by a fungus (Geotricium candida) that acts when the PH has fallen to about 4.2, increasing the acidification and producing the characteristic aroma. Hydrogen cyanide is liberated during fermentation through the spontaneous hydrolysis of the cyanogenic glucoside of cassava at a low PH value. Many attempts are being made in Nigeria to mechanize garri production under hygienic condition as well as to fortify this low-nutrition food with a protein additive.

CASSAVA RICE (LANDANG)

Similar in properties to these products is landang, or cassava rice, a popular food in the Philippines. Landang retains much of the protein of the cassava root. It is used in the Philippines as a substitute for rice or maize. It may be kept for six months before being attacked by moulds.

This product is prepared by shredding the tubers and pressing the grated mass in a cloth until most of the juice is squeezed out. By whirling the mass in a winnowing basket, pellets are formed, their size determined by the speed of the motion and the moisture content. Pellets of more or less uniform size are isolated by sifting, steamed and then dried in the sun for some days. Alternatively, the tubers are soaked in water in earthenware jars (contact with metal should be avoided) until after five to seven days they begin to soften. Then they are macerated, the fibre is removed by hand and the mass is air dried before being made into pellets in the way just mentioned.

In India the production of a synthetic rice based on cassava has recently been started.

CASSARIPO OR TUCUPAY

Nowadays the squeezed juice obtained during the preparations mentioned above is mostly thrown away. In south America, however, there is an ancient belief that the juice contains many valuable nutrients.

The method used is to concentrate the juice by means of evaporation, and then add various spicies, including chilliest the resulting sauce, which is very similar to a soybean sauce, is called cassaripo or caslup in the west indies and tucupay in Brazil. If sufficiently concentrated, it may be kept indefinitely. In the cooking process any content of prussic acid is destroyed; in fact, the bitter varieties of cassava give the best cassaripo. In the west indies, cassaripo (west Indian pepper pot) is used in the conservation of fish or meat, in which case, however, it should be reboiled daily. It is to be regretted that this preparation is out of use now and even totally unknown in countries which are in great need of nutritional condiments.

PASTES

Various forms of heavy cassava paste are made by pounding the fresh or boiled roots into a very smooth mass which is eaten as a vegetable loaf with an oily sauce. Examples of these products are the fufu of Ghana, the dumbot of Liberia, the atieke of Ivory Coast, the bami of other areas.

NEW VEGETABLE CHEESE PRODUCT

The relative absence in cassava of essential food components, particularly protein, which makes it a cause of malnutrition, has led to the investigation of various methods of adding protein and other nutrients to this basic food. The tropical products institute in London has undertaken studies of yeast culture on cassava and

a vegetable cheese is made by the nutritional enrichment of cassava through fermentation. The process consists of fermentation of a cake of extruded cassava dough to which mineral salts are added with a spore inoculum of a selected strain of Rhizopus stolonifera. Crude protein levels have been raised from 0.1 to 4.0 percent and the vegetable cheese product is acceptable for direct use in cooking.

2.6 Fortification of Traditional Delicacy Meal with Cassava

Cassava is the perennial herbaceous vine cultivated for the consumption of their starchy tubers in Africa, Asia. Due to other abundance and consequently, their importance to survival, cassava was highly regarded in Nigeria ceremonial culture and even worshipped before the introduction of cereals and grains in west Africa.

Cassava was the major source of carbohydrate. Ukpabi (1992) reports that cassava is considered a man's crop and has ritual and socio-cultural significance. Today, cassava is grown widely throughout the tropics.

2.7 Processing and Utilization of Cassava Flour

Processing will greatly increase the utilization of root crops, the flour can be used as a component of multi mix baby foods and in composite flour for making bread.

The food and agricultural organization (1987) have reported that, processing of cassava involves peeling the root then cutting into slices, blanching and dried.

Peeling can be affected by immersion in 10% iye solution or by steaming at high temperature (150^{o}c) for short period. Iwe (2003).

CHAPTER THREE

METHODOLOGY

3.0 Introduction

In this chapter, the research will presents the materials and the methods adapted in experimenting the research topic. The researcher will be presenting the method use in utilization of cassava for the production of instant fufu, and the flow chart and recipe/cooking methodology. Finally this chapter will present the methodology for sensory evaluation.

3.1 Flow Chart of Instant Fufu

Fresh cassava roots

↓

Cleaning

↓

Peeling and washing

↓

Soaking (fermentation)-96h

↓

Sieving-shaft removal

↓

Setting

↓

Dewatering/pressing

↓

Drying

↓

Milling

↓

Packaging

↓

Fufu flour

3.2 Sample of Menu Prepared

Water 500ml

Instant fufu paste 250g

METHOD OF PREPARATION

Combine fufu paste with cassava paste with water or proper mixing inside a clean and hallow pot.

Light the gas and place the hallow pot containing the paste on fire

Turn and stir continuously in order to avoid lumbs

Add water to it gradually to the paste as it get harder

Turn until it becomes soft in texture and well cooked

Then, it is ready to be served with any soup of your choice

3.3 Material Used in Carrying Cut the Experimental

METHOD ARE:

Hallow pot

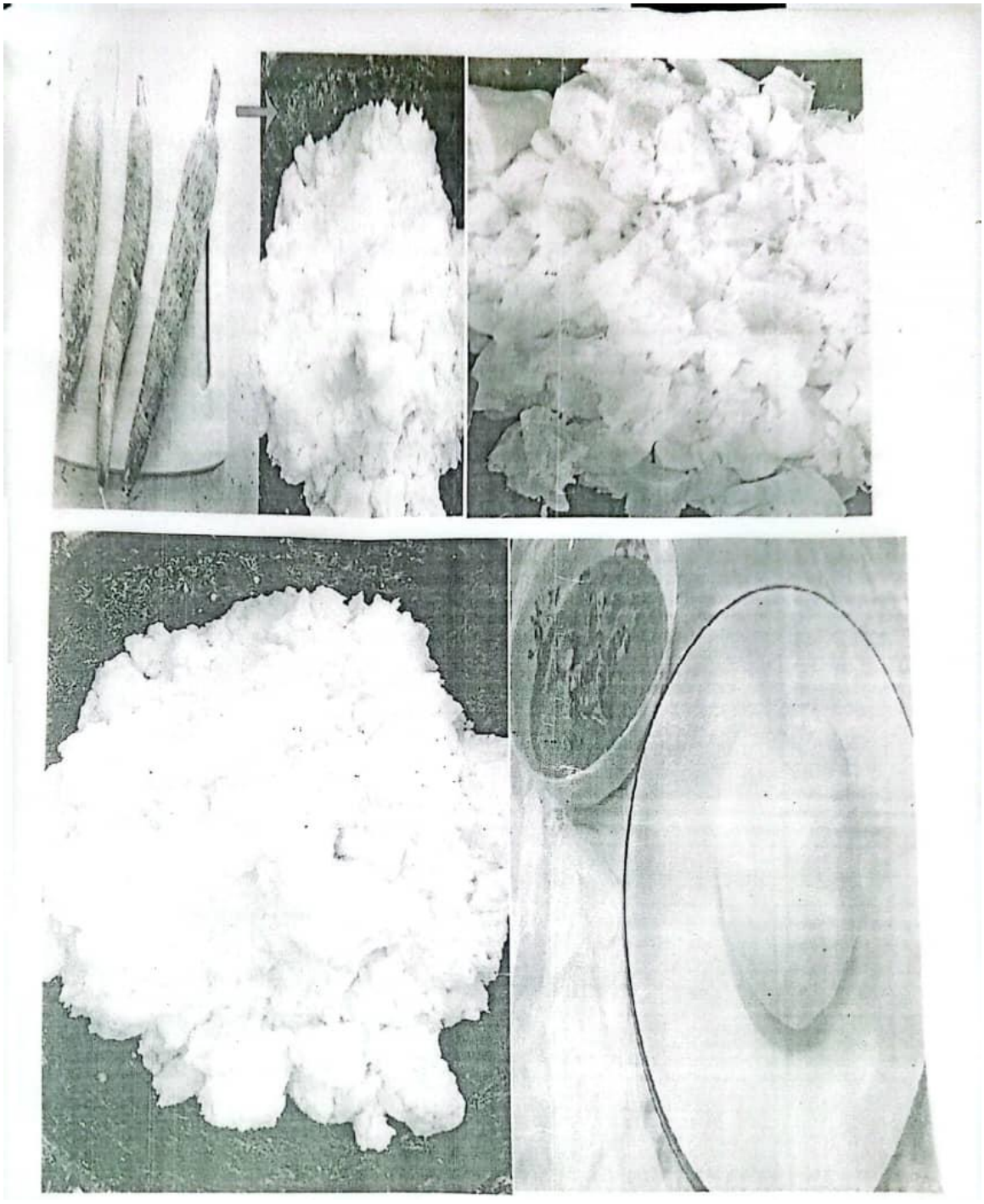
Spoon (kitchen spoon)

Turning stick

Cylinder

Nylon

Plate



3.4 Methodology for Sensory Evaluation

Sensory evaluation is a scientific discipline that applies principles of experimental design and statistical analysis to the use of human sense (sight, smell, taste, touch, hearing) for the purpose of evaluating consumer products.

In this research project, affective testing will be utilized. Affective testing also known as consumer testing is type of testing that is concerned with obtaining subjective data, or how well products likely to be accepted usually large (30 or more) panels of untrained personnel are recruited for this type of testing, although smaller focus groups can be utilized to gain insights into products.

The range of testing can vary from simple comparative to structured questioning regarding the magnitude of acceptance of individual characteristics for the product.

Sensory evaluation for the instant fufu made from the utilization of cassava is done using affective testing through the design of a structured questionnaire. The questionnaires are administered to carefully selected panels of personnel recruited for this type of testing after consumption of the instant fufu.

The questionnaire consists of the following structured sensory evaluation form. Please tick the rating of your choice from excellent to poor as shown below:

3.5 Table: Sensory evaluation of 100 instant fufu

Variables	Excellent	Very good	Good	Fair	Poor	Total
Appearance						
Texture						
Taste						
Aroma						
Acceptability						

CHAPTER FOUR

ANALYSIS AND DISCUSSION

4.1 Presentation, Analysis and Interpretation

The fufu produced using the method illustrated were presented to taste panel of 20 people. They were requested to tick the sensory evaluation provided regarding the taste, smell, appearance, colour and palatability of the product and the result is presented and shown below.

4.2 Presentation and Analysis

Fufu can best be described as sour, bland, or tart. Fufu is not eaten alone and is usually eaten with an Africa soup, which is usually very rich and flavorful and sometimes spicy.

4.3 Discussion and Finding

Like many traditional west African ingredients and dishes fufu has immense health benefits not only is it low cholesterol, it is rich in fiber potassium and resistant starch which feeds the beneficial bacteria in your gut and many help reduce inflammation and promote digestive health and contain vitamin C.

4.4 Appearance and Colour

Fufu flour should be creamier in appearance to increase their acceptability.

Fufu of a good quality will either have a creamy-white, grey or yellow colour.

4.5 Sensory Evaluation of Instant Fufu

GRADE	EXCELLENT	VERY GOOD	GOOD	FAIR	TOTAL
APPEARANCE	10	18	12	-	40
TEXTURE	10	18	10	2	40
TASTE	18	12	6	4	40
AROMA	14	10	14	2	40
COLOUR	4	18	14	4	40
ACCEPTABILITY	12	14	10	4	40

DISCUSSION AND INTERPRETATION OF RESULT IN PERCENTAGE

GRADE	EXCELLENT	VERY GOOD	GOOD	FAIR	TOTAL
APPEARANCE	25%	45%	30%	-	100%
TEXTURE	25%	45%	25%	5%	100%
TASTE	45%	30%	15%	10%	100%
AROMA	35%	25%	35%	5%	100%
COLOUR	10%	45%	35%	10%	100%
ACCEPTABILITY	30%	35%	25%	10%	100%

Out of the 20% population that was used for the appearance of the instant fufu 50% rated the product excellent, 90% rated the appearance of the instant fufu very good.

The texture of the fufu was rated excellent by 50% respondents, 90% respondents rated it very good, 50% respondent rated the texture of the fufu good, while 10% respondent rated it fair.

Taste, 90% rated it excellent, 60% respondent rated it very good, 30% respondent rated it good, while 20% respondent rated it fair.

Aroma, 70% rated it excellent, 50% respondent rated it very good, 70% respondent rated it good. While 10% rated it fair.

Colour, 20% respondent rated it excellent, 90% respondent rated it very good, 70% respondent rated it good, while 20% respondent rated it fair.

Acceptability, 60% respondent rated the acceptability of the fufu excellent, 70% rated it very good, 50% rated it good. While 20% respondent rated the instant fufu fair.

From the result, it is obvious that instant fufu is generally acceptable to the people.

4.6 Health Benefit of Instant Fufu

FUFU IS A LOW CHOLESTEROL FOOD

Fufu or akpu is very low in cholesterol. High cholesterol can limit blood flow, increasing the risk of a heart attack or stroke. It is detected by a blood test. In this heart condition, excess LDL cholesterol builds up as plaque in the small arteries of

your heart, narrowing and stiffening them. This reduces blood flow, which can make you feel tired or short of breath, as well as cause chest pain.

FUFU IS RICH IN POTASSIUM

Fufu is very rich in potassium and it is commonly prescribed by doctors for people who have low level of potassium in their blood. Potassium is one of the most important minerals in the body. It helps regulate fluid balance, muscle contractions and nerve signals. What's more, a high-potassium diet may help reduce blood pressure and water retention, protect against stroke and prevent osteoporosis and kidney stones.

FUFU IS GOOD SOURCE OF FIBRE

Fufu or akpu is a good source of fibre which is very beneficial in improving the digestive system and overall health. Studies also have shown that high-fibre foods may have other heart-health benefits, such as reducing blood pressure and inflammation. Helps control blood sugar levels. In people with diabetes, fibre particularly soluble fibre can slow the absorption of sugar and help improve blood sugar levels.

HIGH IN RESISTANT STARCH

Fufu is high in resistant starch, a type of starch that bypasses digestion and has properties similar to soluble fibre. Consuming foods that are high in resistant

starch may have several benefits for overall health. First of all, resistant starch feeds the beneficial bacteria in your gut, which may help reduce inflammation and promote digestive health. Resistant starch has also been studied for its ability to contribute to better metabolic health and reduce the risk of obesity and type 2 diabetes. This is due to its potential to improve blood sugar control, in addition to its role in promoting fullness and reducing appetite. The benefits of resistant starch are promising, but it is important to note that many processing methods may lower fufu's resistant starch credentials.

EXCELLENT SOURCE OF ENERGY

Fufu is a super source of energy. One of the primary functions of carbohydrate food like fufu is to provide your body with energy. Most of the carbohydrates in the foods you eat are digested and broken down into glucose before entering the bloodstream. Complex carbohydrates are an efficient source of energy that fuel muscle contractions. Once eaten, carbs are broken down into smaller sugars (glucose, fructose, and galactose) to be used as energy for immediate tasks. Any unused glucose will be converted into glycogen and stored in the muscles and liver for future.

GOOD SOURCE OF KEY VITAMINS AND MINERALS

Fufu made from cassava is a calorie-rich source of key vitamins and minerals. It contains vitamin C, thiamine, riboflavin, and niacin:

Vitamin C: This vitamin also known as ascorbic acid, is necessary for the growth, development and repair of all body tissues. It's involved in many body functions, including formation of collagen, absorption of iron, the immune system, wound healing, and the maintenance of cartilage, bones and teeth.

Thiamine: Thiamine is important in the breakdown of carbohydrates from foods into products needed by the body. It is one of 8 B vitamins. All B vitamins helps the body convert food (carbohydrates) into fuel (glucose), which the body uses to produce energy. These B vitamins, often referred to as B-complex vitamins, also help the body metabolize fats and protein.

Riboflavin: Is a vitamin that is needed for growth and overall good health. It helps the body break down carbohydrates, proteins and fats to produce energy, and it allows oxygen to be used by the body. The signs and symptoms of riboflavin deficiency (also known as ariboflavinosis) include skin disorders, hyperemia (excess blood) and edema of the mouth and throat, angular stomatitis (lesions at the corners of the mouth), cheilosis (swollen, cracked lips), hair loss, reproductive problems and sore throat.

Niacin: Like other B vitamins, niacin helps the body break down carbohydrates, fats and proteins into energy, deficiency of this vitamin is a condition that occurs when a person doesn't get enough or can't absorb niacin or its amino acid precursor, tryptophan, there have been outbreaks of niacin deficiency in areas of the world where food is scarce.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

In this research work, confirmation has been made that cassava in instant fufu can be used in different establishment and can also be used in the hospitality management.

Analyzing shows that the cassava plate can be made into powdered form to enhance their acceptability by the consumers as judged by the tables above and increase its life span.

5.2 Conclusion

Result from this study suggested that enrich cassava flour with cassava a flour 100%, 100%, 100%, 100% would not only produce a more nutritionally balanced and acceptable products. The result indicated that the cassava flour was able to increase the protein content as well as all other proximate composition except carbohydrate in the various combinations. Also, the amino acid profile of cassava increased with increasing the enrichment levels. However, the characteristics of cassava dough were affected, as water absorption rate was increased with the enrichment level increment. The increase in protein and carbohydrate level with

substitution improve textural property and extension property. Resulted in notable increase in protein content which could be nutritionally advantageous to Nigeria where many people can hardly afford high proteaceous food because of the cost. Since cassava is cheaper and readily available the cassava flour would have little or no effect on the price of the product enrichment with soy bean can also reduce the problem of malnutrition in places where cassava is consumed as a staple food.

5.3 Recommendations

Our recommendations suggest wide latitude for local market developments and intervention. It was found that cassava material required by processors were in short supply by 57.9, 2.7 and 790 percent for bean would and meal respectively. This shortage in supply is a product of several factors ranging from low productivity of cassava. Farmers, segmented nature of cassava supply, lack of capital for installing separate processing machines for cassava and inconsistency in government policies on importation of common problems faced by sector of the Nigerian economy.

These findings suggest the need for a well-articulated support for sustainable production of cassava in the country. Some majority of the producers are small-scale farmers, the challenge is to re-examine the production constraints and develop mechanisms that would facilitate their unimpeded access to the benefits of improved

production and markets when it happens. The first thing to do to make this happen, however, is capacity building and improvement of production technology of small-scale farmers in order to upgrade and add value to their production to supply large commercial buyers directly the appropriate quantities and quality of raw materials.

REFERENCES

Abiodun, O. A., Akinoso, R., & Olaoti, O. J. (2014). Changes in functional and pasting properties of trifoliate yam flour during storage. *Journal of Applied Science and Environmental Management, 18*(2), 337-340.

Abraham, E. T. (2013). Stabilization of paste viscosity of cassava by heat moisture treatment. *Starch/Stärke, 45*(3), 131-135.

Adebowale, A. A., Sanni, L. O., & Kuye, A. (2006). Effect of roasting methods on sorption isotherm of tapioca grits. *Electronic Journal of Environment, Agriculture and Food Chemistry, 5*(6), 1649-1653.

Adebowale, A. R., Sanni, L., Awonorin, S., Daniel, I., & Kuye, A. (2007). Effect of cassava varieties on the sorption isotherm of tapioca grits. *International Journal of Food Science and Technology, 42*, 448-452.

Adeshina, B. S., & Bolaji, O. T. (2013). Effect of milling machines and sieve sizes on cooked cassava flour quality. *Nigeria Food Journal, 31*(1), 115-119.

Adetan, D. A., Adekoya, L. O., & Aluko, O. B. (2006). Theory of a mechanical method of peeling cassava tubers with knives. *International Agrophysics, 20*, 269-276.

Akindahunsi, A. A., Oboh, G., & Oshodi, A. A. (2009). Effect of fermenting cassava with *Rhizopus oryzae* on the chemical composition of its flour and garri. *La Rivista Italiana Delle Sostanze Grasse, 76*, 437-440.

Babajide, J. M., & Olowe, S. (2013). Chemical, functional and sensory properties of water yam-cassava flour and its paste. *International Food Research Journal, 20*(2), 903-909.

Balagopalan, S. N. (2008). Cassava nutrition and toxicity. In R. J. Hillocks, J. M. Trsh, & A. C. Belloti (Eds.), *Cassava in food, feed and industry* (pp. 13-36). CRC Press.

Barbosa, V. (2015). Prospect for production of *Pleurotus sajor-caju* from cassava fibrous waste. In S. Roussos & B. K. Lonsane (Eds.), *Advances in solid state fermentation: Proceedings of the 2nd International Symposium on Solid State Fermentation* (pp. 515-527). Springer.

Cassavabiz. (2005). Cassava utilization: Integrated cassava project. Retrieved October 25, 2014, from http://www.cassavabiz.org/postharvest

Charles, A. L., & Chang, Y. H. (2007). Study of wheat flour-cassava starch composite mix and the function of cassava mucilage in Chinese noodle. *Hydrocolloids, 21*, 368-378.

Cheow, C. S., Y. U., S. Y., & Howell, N. K. (1999). Effect of salt, sugar and monosodium glutamate on the viscoelastic properties of fish cracker (Keropok) gel. *Journal of Food Processing and Preservation, 23*(1), 21-37.

Chiste, R. C., Silva, P. A., Lopes, A. S., & da Silva Pena, R. (2012). Sorption isotherms of tapioca flour. *International Journal of Food Science and Technology, 47*(4), 870-874.

Chiwona-Karltun, L. J. (2015). Reasons for use of bitter cassava: A priority in cassava production in Malawi. In *Root crops and poverty alleviation* (pp. 313-315). ISTRC-AB.

Das, D., & Veziroglu, T. N. (2001). Hydrogen production by biological processes: A survey of literature. *International Journal of Hydrogen Energy, 26*(1), 13-28.

Davies, R. M., Olatunji, M. O., & Burubai, W. (2008). A survey of cassava processing machinery in Oyo State. *World Journal of Agricultural Sciences, 4*(3), 337-340.

Defloor, I., & Delcour, J. A. (1993). Impact of milling procedure on breadmaking potential of cassava flour in wheatless breads. *Cereal Chemistry, 70*, 616-617.

Ejiofor, A. O. (2016). Culture of *Saccharomyces cerevisiae* on hydrolyzed waste cassava starch for production of baking quality yeast. *Enzyme and Microbial Technology, 18*(7), 519-525.

Ejoh, E. O. (2013). Extending the use of an underutilized tuber I: Physicochemical and pasting properties of cocoyam (*Xanthosoma sagittifolium*) flour and its suitability for making biscuits. *African Journal of Food Science, 7*(9), 264-273.

Kolawole, P. O., & Abass, A. (2012). Innovative development of cassava processing machine as a solution to crisis against agricultural systems. In *Tropentag* (pp. 19-21). Göttingen, Germany.