Development of a HACCP System for the Preparation of Massa from Millet: A Traditional Fried Sour Cake

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CHAPTER ONE: INTRODUCTION

1. INTRODUCTION

Millets are small-grained cereals. They form part of the staple food of the millions inhabiting the arid and semi-arid regions of the world. Finger, Proso and Foxtail millets are just a few examples of the types of millet which are found all over the world. Millets are processed into different types of food using different processing techniques. The most common food preparations made from millets include porridge, bread and pancakes. Millets are sometimes nutritionally superior to rice or wheat because they provide more proteins, vitamins, minerals and oils where the need for such nutrients is maximum (Seetharam et al, 1989). Millets are also gluten free which make them the ideal cereal choice for people who have allergic reactions towards gluten. (http://www.healthrecipes.com/millet.htm). It is not an acid forming food so it is soothing and easy to digest. Millet is a warming grain therefore it helps to heat the body in cold or rainy seasons and climates. Millets are rich in phytochemicals, including Phytic acid, which is believed to lower cholesterol, and Phytate, which is associated with reduced cancer risk. Millet ranks as the sixth most important grain in the world, sustains 1/3 of the world's population and is a significant part of the diet in northern China, Japan, Manchuria and various areas of the former Soviet Union, Africa, India, and Egypt. (http://chetday.com/millet.html). Millet is used in various cultures in many diverse ways. In Eastern Europe millet is used in porridge and kasha, or is fermented into a beverage and in Africa it is used to make bread, as baby food, and as *uji*, a thin gruel used as breakfast porridge. It is also used as a stuffing ingredient for cabbage rolls in some countries. The manufacture of value added products from millets will help to upgrade the economic status of millet growers, and improve the nutritional status of economically handicapped communities. Millet can be used as substitutes to wheat and rice in food products. They can also be processed into new foods suitable to infants and invalids after the necessary fortification.

Massa is a meal made from fermented millet, rice, maize or sorghum. Fermentation is the term given to any desirable change that a microorganism imparts to food whiles producing alcohols and acids as by-products (Nester et al, 2004). The fermentation process is usually spontaneous and occurs even without the purposeful addition of starter cultures. However, some foods are intentionally altered by carefully controlling the activity of microorganisms. Fermentation of foods preserves the food and/or gives the food a desirable flavor, taste and texture. During fermentation, organic substances e.g. sugars are converted to simpler substances, e.g. alcohol by the action of yeasts or bacteria. (Principles of Food Science, 1968)

In traditional food production, methods are based on experience, and safety is taken for granted. Regulatory methods (food control) are based on observation, smelling and tasting of the food. However, the system is retroactive and provides little health protection, particularly regarding pathogenic organisms.

2. ISO 22000

An international standard which addresses the safety of foods and which can be applied to traditional food processing in Ghana based on selected elements of the system is ISO 22000. ISO 22000 addresses the safety of foods with the aim of harmonising requirements for food safety management for businesses or operators in the food chain on a global level. The international standard recognizes that food safety is related to the presence of food-borne hazards in food at the point of consumption. Since introduction of food safety hazards can occur at any stage of the food chain, the standard considers it essential to have adequate control over all activities throughout the food chain. Furthermore such control can only be ensured through the combined efforts of all parties participating in the food chain including producers of the agricultural produce, processors and manufactures, transport and storage operators, distributors, food service outlets and other retailers including street food vendors in the case of most African countries. As the key elements in ensuring food safety among these operators up to the point of consumption, the standard specifies requirements for a food safety

management system that combines interactive communication, system management, prerequisite programmes and HACCP principles. ISO 22000 is therefore essentially a combination of the HACCP plan and prerequisite programmes (PRP) such as GMP. It recognizes hazard analysis as the key to an effective food safety management system, requiring that all hazards that may be reasonably expected to occur in the food chain, including hazards that may be associated with the type of process and facilities used are identified and assessed. During the hazard analysis, the strategy to be used to ensure control of the standard by combing the prerequisite programme and the HACCP plan is determined.

To address the issue of the safety of Massa at the micro and small enterprise (MSE) level this work was carried out to develop a HACCP system for Massa which can be applied to the traditional process at the micro enterprise level.

2.1 HACCP

Hazard analysis and critical control points (HACCP), is a method of food safety assurance. It identifies what needs to be done to make food safe and it makes sure that what is planned is correctly implemented. HACCP does not guarantee that the food has an acceptable quality but it guarantees an acceptable hygienic standard.

HACCP is a system which identifies, evaluates and controls hazards which are significant for food safety. It is a scientific rational approach to the identification, assessment and control of hazards during production, processing, manufacturing, preparation and use of food to ensure that the food is safe when it is consumed. Some of the objectives of HACCP include the prevention of food-borne illness, reduction of costs of food analyses, maintenance of a more efficient quality assurance system and protection of the reputation of food manufacturing or processing companies. The HACCP concept incorporates;

- Identification of potential food safety problems
- Determination of how and where these can be prevented, eliminated or controlled
- Description of what needs to be done and who should do it

- Identification of personnel training needs
- Implementation and record-keeping

There are seven basic principles of HACCP. These are

1. Conduct a hazard analysis i.e. collecting and interpreting information on hazards and conditions leading to their occurrence to decide which of them are significant for food safety and should be addressed in the HACCP plan. A hazard is a biological, physical or chemical agent in or condition of food with the potential to cause an adverse health effect.
2. Determine the critical control points (CCPs) i.e. steps in the food chain at which control of a factor or parameter is essential to prevent or eliminate a food safety hazard or reduce it to an acceptable level. CCPs can be related to raw materials, practices or processes.
3. Establish critical limits (CLs) for each CCP identified. The CL is a criterion or value which separates acceptability from unacceptability.
4. Establish a system to monitor the control of the CCP. This can be done by measuring, testing or observing to make sure that a particular CCP is within the critical limits.
5. Establish the corrective action to be taken when monitoring indicates that a particular CCP is not under control
6. Establish procedures for verification to confirm that the whole HACCP system is working effectively. Verification involves the application of methods, procedures, tests, and other evaluations in addition to monitoring to determine compliance with the HACCP system.
7. Establish record keeping and documentation of all activities related to the HACCP system.

The HACCP principles are given in the Codex Alimentarious Commission (2003) and the National Advisory Committee on Microbiological criteria for foods (NACMF, 1992) (Forsythe et al, 1998)

For the successful implementation of HACCP, some salient steps are to be followed. These are given in the Codex HACCP guidelines

1. Assemble the HACCP team. Obtain top management commitment. The team should be made up of experts in quality assurance
2. Describe the product- formulation and composition, raw materials, processing, packaging, etc
3. Identify the intended use of the product
4. Construct a flow diagram of the product formulation
5. Confirm on-site flow diagram
6. List all potential hazards
7. Conduct a hazard analysis and consider control measures
8. Determine the CCPs
9. Establish critical limits
10. Establish a monitoring system
11. Establish corrective actions
12. Establish verification procedures
13. Establish documentation

2.2 OBJECTIVE OF WORK

The main objective of this work is to develop a HACCP system that can be applied at the micro and small scale enterprise (MSE) level to ensure the safety of Massa which is prepared and sold by traditional processors.

CHAPTER TWO: HACCP SYSTEM FOR MASSA

3. THE HACCP TEAM

The team should be made up of the plant owner, the general supervisor of the production process and a quality assurance expert.

3.1THE PRODUCT

Massa is a fermented meal made from millet. To prepare Massa, millet is steeped in water for about 24hours to ferment. The steeped water has an average pH of 6.15 at 0hr and 4.96 at 24hrs. The water is drained and the millet is course-milled. Half of the milled millet is made into stiff dough (aflata) by continuous stirring on fire. The aflata is mixed with the other half of the milled millet to produce dough. The dough is left overnight for further fermentation to take place. The fermented dough has an average pH of 5.44 at 0hr, 4.48 at 4hrs, 3.96 at 8hrs and 3.84 at 12hrs. The dough has an average moisture content of 66.67%. The fermented millet dough is fried in shallow cup-like depressions until it looks golden brown. Massa has a shelf life of 3 days and should be stored below 8°C or above 63^0C. Massa should contain less than 100 colony forming units of aerobic mesophilic bacteria and should not contain any pathogenic micro organisms, for example, *Salmonella.* Aflatoxins present in the product should not exceed 10 parts per billion.

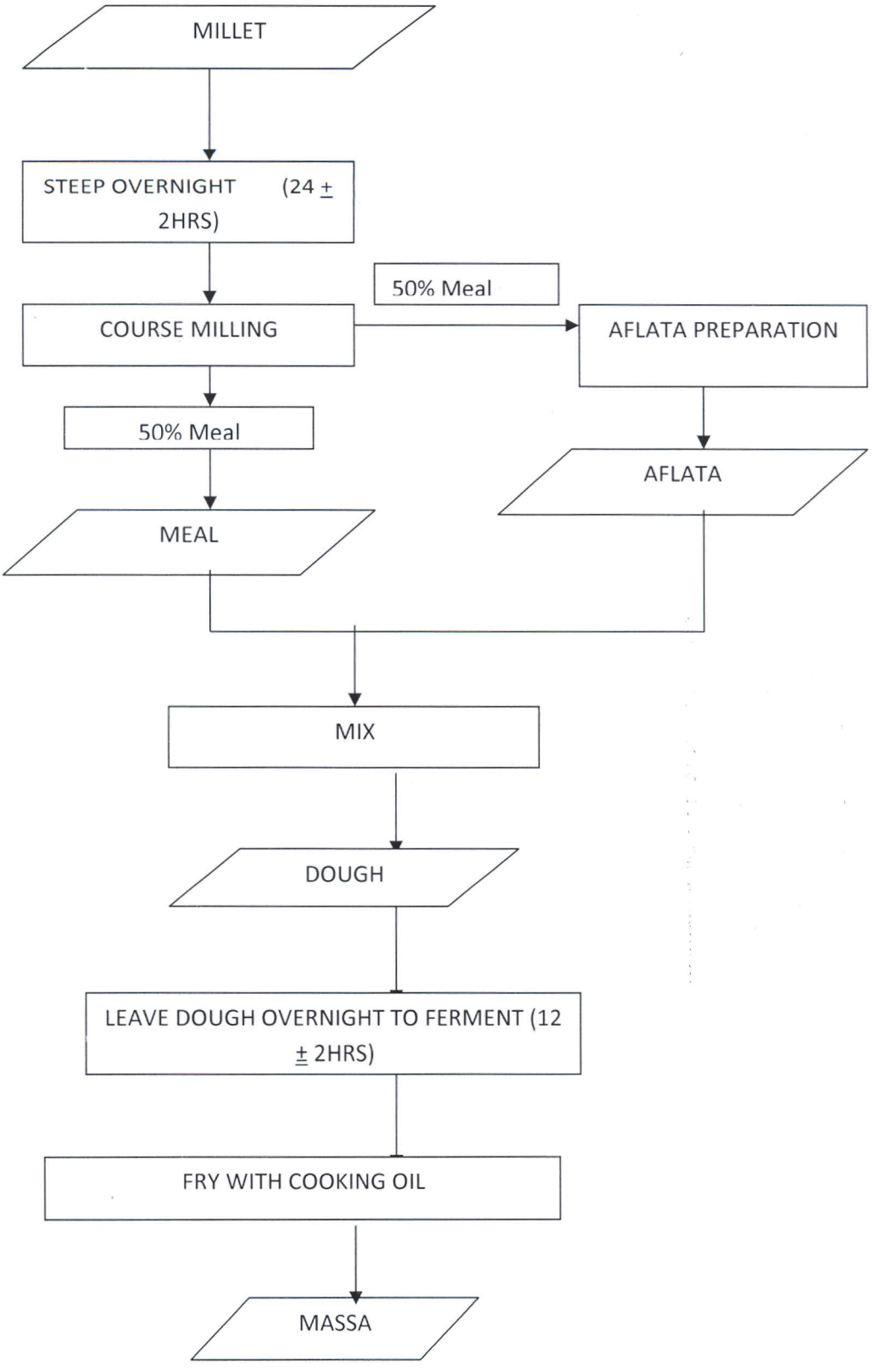
3.1.2 INTENDED USE OF MASSA

Massa can be consumed as a snack or as part of a cereal-based breakfast, e.g., maize porridge. Massa can either be served at temperatures between 8°C and 63°C or served

3.1.3 FLOW DIAGRAM OF THE PRODUCT FORMULATION

The flow diagram should be compared to the actual practice on the production plant to confirm that the diagram corresponds with the actual field work. The flow diagram also aids in the identification, evaluation and assessment of hazards which are significant for the food safety.

FLOW DIAGRAM SHOWING THE PREPARATION OF MASSA



3.2 IDENTIFICATION OF HAZARDS

Hazard identification should start from the raw material and end at the finished product. During the sale and storage of millet, aflatoxin-producing moulds e.g. *Aspergillus* can grow and cause adverse health effects when consumed over a long period. Aflatoxins are known to have carcinogenic effects on man when ingested over a long period. Microorganisms, in general, need a conducive environment for optimal growth. Some of the environmental requirements for microbial growth include water activity (i.e. the right moisture level), right temperature, and right pH. Therefore to control microbial growth, moisture levels of the millet should be low. This can be achieved by effective and rapid drying of the millet grains once harvested. The supplier of the millet should have documentation to show how and for how long the millet grains were dried. The supplier should also have documentation to prove that the millet grains are free from aflatoxin-producing moulds.

The water used for the Massa production should be of sound quality. It can serve as a source of microbial contamination if it is not controlled.

During steeping, the growth of spoilage micro organisms can occur if the steeping is not done well. The use of unwholesome water for steeping, steeping at the wrong temperature and for the wrong time will result in the proliferation of microorganisms which may be harmful to human health.

The dough fermentation can encourage aflatoxin-producing moulds and other microorganisms to grow and proliferate if it is not done for the right time and at the right temperature.

During frying, there is the possibility that pathogenic microorganisms can survive if the frying is not done well. The best way to reduce or get rid of the microorganisms is to fry at a core temperature of 72°C for 2 minutes.

3.2.1 CRITICAL CONTROL POINTS, CRITICAL LIMITS AND CONTROL MEASURES

The HACCP team will identify the CCPs and determine the appropriate control measures for each CCP.

The CCPs, critical limits and control measures identified for the production of Massa are as follows

- The raw material; millet. This raw material is a CCP because the microbiological safety of the millet will determine the microbiological safety of the end-product. Millet that is used for the production of Massa sho uld be free from foreign materials like stones, glass, wood etc. The millet that is used should also be free from aflatoxin-producing moulds. This can be ascertained by visual inspection of the millet to make sure that the millet is dry and is not mouldy. Also the millet should be smelled to make sure it does not have an odour which is uncharacteristic of millets. Documents confirming the supplier quality assurance should also be inspected.

- The raw material; water. Water that is used for steeping the millet should be odourless, clear and should be of sound quality. The water can be a source of microbial contamination if it is not of sound quality. The water should be smelled and observed visually for any uncharacteristic odour and colour.

- The process step; steeping. Steeping of the millet should be done at the right temperature and for the right time. If the millet is steeped at ambient temperatures and for the wrong time period, spoilage microorganisms can grow and proliferate, therefore the millet should be steeped at temperatures below 30°C for 14 $\pm$ 2hours. This can be checked by frequent monitoring of temperature and time. Also these microorganisms can grow at slightly alkaline pHs therefore an acidic pH inhibits their growth. A regular pH measurement of the steeping water is a control to check that the pH is rapidly acidic (6.15 to 4.96 $\pm$ 0.2 after 24hrs.) to ensure the inhibitory attributes to microbiological growth.

- The process step; dough fermentation. The fermentation of the dough is a CCP because microorganisms can grow and proliferate when the substrate gives them a conducive environment in which they can grow. This can be controlled by fermenting for the right time and at the right temperature, i.e. for12 $\pm$ 2 hours

below 30°C. The pH of the dough should also be checked frequently to make sure that the dough is rapidly acidic (5.44 to 3.84 after 12hrs).

- The process step; frying. Frying of the millet should be done at a core temperature of 72°C for 2mins. This temperature and time combination will ensure most microorganisms are killed. If the frying is not done at these time and temperature specifications, microorganisms can survive, grow and proliferate.

3.2.2 ESTABLISHMENT OF MONITORING SYSTEMS FOR EACH CCP.

Each of the CCP identified should be monitored by regular measurements. Upon reception of the raw material millet, documentation of the supplier quality assurance should be inspected. The millet should also be inspected for any uncharacteristic properties, e.g. growth of moulds, presence of pests and other foreign materials like stones and glass. The water that is used for the Massa production should also be smelled for any offensive odours and visually inspected for the presence of particles. The water should be clean and clear. During steeping and dough fermentation, the pH, time and temperature should be checked regularly and recorded. The temperature and time period for which the Massa was fried should be measured and recorded for each batch.

3.2.3 ESTABLISHMENT OF CORRECTIVE MEASURES

When the millet that is to be used for the production of Massa is unwholesome, it should be rejected. The water that is used for the processing of Massa should be boiled and strained before use if it is not clean and has an uncharacteristic odour. If the pH of the steeping water does not fall in the critical limits, steep for a longer time until the desired pH is reached. If the steeping water has a bad smell, the water should be drained from the millet, and the millet should be re-steeped after washing. The dough should be rejected if it has an offensive smell after fermentation. The dough should be fermented for a longer time if the pH does not reach the optimum after 12hrs. The frying temperature should be adjusted to reach the required temperature, and the frying should be done for the right time.

3.2.4 ESTABLISHMENT OF VERIFICATION PROCEDURES

The verification procedures should be carried out every week on all stages of the production of the Massa. It should involve microbiological and chemical analysis of the raw materials, process steps and the end product. External Audits should be carried out twice a year by a multidisciplinary team of auditors. The audits are supposed to verify that the right things are being done and the HACCP system is working effectively. Internal audits should also be done every quarter to ensure that the HACCP system is efficient. This will be done by inspecting all documents relating to the HACCP system. The end product should be tested for the presence of any microorganism and mycotoxins. This should be done once a week. The pH and moisture content of the dough should be measured and recorded once a week. The pH of the steeping water should also be measured once a week to make sure that it falls within the required range.

A new HACCP system should be created for any change in the production process. Changes may include a change in ingredients, product formulations, intended use etc.

3.2.5 DOCUMENTATION

Every single step related to the HACCP system should be documented on appropriate forms. Forms should be appropriately coded for easy identification. Forms should be dated and the revision number stated on each of them. All the forms should have the signature of the person(s) who approve(s) them. There shall be forms for instructions which would be labeled I.n where n is the form number. There shall also be forms for recording values and documenting the corrective actions taken. These forms shall be labeled D.n where n is the form number.

INSTRUCTION FORMS

4.0 MANAGEMENT COMMITMENT AND RESPONSIBILITY

This form deals with the commitment of management. Management and owners of the Massa production plant shall be committed to the implementation of the HACCP system in all aspects, from the purchasing of the raw materials through the production process to the final dispatch of the end-product. Management will be responsible for making use of high quality raw materials and ensuring good manufacturing practices at the production site. Management shall also be responsible for keeping and maintaining a standard production building with respect to facilities and resources available to workers at the plant. Management shall train or organize training sessions for personnel at the production site to upgrade their knowledge, skills and expertise levels.

Management shall ensure that the HACCP system is reviewed twice a year and all documents pertaining to the HACCP system is kept under specific conditions.

4.1 THE HACCP TEAM

The HACCP team shall be made up of

- The plant owner
- The general supervisor of the production process
- A secretary who records proceedings of all meetings
- Quality assurance experts in food microbiology ,food technology and food chemistry

4.1.2 RESPONSIBILITY OF THE HACCP TEAM

The HACCP team will have the following responsibilities

1. Describe the product- formulation and composition, raw materials, processing, packaging, etc
2. Identify the intended use of the product

3. Construct a flow diagram of the product formulation
4. Confirm on-site the flow diagram
5. List all potential hazards
6. Conduct a hazard analysis and consider control measures
7. Determine the CCPs
8. Establish the critical limits for each of the CCPs
9. Establish a monitoring system
10. Establish corrective actions
11. Establish verification procedures
12. Establish a record-keeping system and design the appropriate forms for each measurement, process, corrective action, monitoring, and audits.
13. Outline the production and working process for personnel to follow.
14. List all analyses that are to be done by external institutions
15. List all the laboratory analyses that are to be carried out to verify the product quality and safety
16. Conduct training sessions on the HACCP system for all personnel involved in the production of massa

4.1.3 HOUSEKEEPING, CLEANING, HYGIENE AND GOOD HYGIENIC PRACTICES

Housing facilities for the production of the Massa shall be free from pests, well ventilated and sited away from refuse dumps. There should be toilets and hand-washing facilities for all workers. The toilet should not be close to where the actual Massa production takes place. Staff shall wash their hands thoroughly with soap and water before starting work, before and after lunch breaks, when leaving or returning to the processing area for any reason, when the hands become unexpectedly soiled or

contaminated in any way such as after handling equipment or food which may be of substandard quality and after visiting the toilet. Sweeping shall be done regularly. Mills shall be washed and disinfected everyday. Bowls which are used for steeping and dough fermentation should be cleaned well after every batch. There shall be regular cleaning and sanitization of all equipment.

Personnel shall maintain high levels of hygiene in all areas of the production process. Personnel shall wear clean clothes and keep short fingernails. Personnel shall keep their hands away from their faces and noses. Personnel shall not spit, eat or drink anything at the site where the actual Massa production takes place. Personnel shall always wear protective clothing and hair nets.

High quality raw materials shall be used for the production of Massa. Water that is used shall be unpolluted. Any type of storage should be done in either a plastic or a metal bowl, never in a wooden bowl.

4.1.4 TRAINING OF PERSONNEL

All personnel involved in the production of Massa shall be trained on the HACCP system. The training shall be done for every new staff and refresher courses shall be organized for staff every 3 months. Staff shall be trained on;

- Good manufacturing and hygienic practices
- The hazards associated with massa production and the principles of the HACCP system
- The specific roles that each of them has to play in the implementation and maintenance of the HACCP system
- Proper documentation methods

All forms of training shall be documented and filed appropriately.

4.1.5 RECORDS KEEPING AND DOCUMENTATION

The plant owner or someone appointed by him/her shall be responsible for the filing and storage of all documents related to the HACCP system. All records shall be kept under a hierarchal filing system for easy traceability. Records should include information on the ingredients (suppliers, storage and all other parameters), product safety, processing (monitored CCPs), packaging, storage and distribution, deviation and corrective measures, validation records, HACCP plan modifications and employee training records.

4.1.6 DOCUMENTATION FORMS

FORM D1*

DATE	BATCH NO.:	RECORDED BY:
MONITORING RESULTS		PAGE 1 OF 2
CCP	TYPE OF TEST	TEST RESULT
MILLET	• Number of bags sampled • Number of bags rejected due to mouldy grains • Number of bags rejected due to poor quality • Number of bags purchased • Extent of dryness	
WATER	• Clearness • Odour • Taste • Presence of foreign matter	

FORM D1*

DATE	BATCH NO.:	RECORDED BY:
MONITORING RESULTS		PAGE 2 OF 2
CCP	TYPE OF TEST	TEST RESULT
STEEPING	• Fermentation period • Final pH of steeping water	
DOUGH FERMENTATION	• Extent of mould growth on surface • Fermentation period • Final pH of fermented dough	
FRYING	• Frying temperature • Frying period	

4.1.7 FORM D2*

LIST OF CORRECTIVE ACTIONS					
DATE	BATCH NUMBER	CCP NO.	CRITICAL LIMIT EXCEEDED	ACTION TAKEN	SIGNATURE

4.1.8 FORM D3*

VERIFICATION RESULTS		PAGE 1 OF 2
DATE:	**BATCH NO.:**	**APPROVED BY:**
MATERIAL	**LABORATORY ANALYSIS**	**RESULTS**
MILLET	• Moisture content • Mould count (cfu/g) • Mycotoxin levels • Aflatoxin B1 • Aflatoxin B2	
STEEP WATER	• Initial pH • Final pH • Initial titratable acidity • Final titratable acidity	
FERMENTED DOUGH	• pH • Titratable acidity • Aerobic mesophiles (cfu/g)	

4.1.9 FORM D3*

VERIFICATION RESULTS		PAGE 2 OF 2
DATE:	**BATCH NO.:**	**APPROVED BY:**
MATERIAL	**LABORATORY ANALYSIS**	**RESULTS**
FERMENTED DOUGH	• Coliforms (cfu/g) • *Escherichia coli* (cfu/g) • Detection of *Salmonella* in 25g of sample	
MASSA	• pH • Titratable acidity • Mycotoxin levels • Aflatoxin B1 • Aflatoxin B2 • Aerobic mesophiles (cfu/g) • Coliforms (cfu/g) • *Escherichia coli* (cfu/g) • Detection of *Salmonella* in 25g of sample	

DATE:.....

LABORATORY MANAGER:.....**SIGNATURE**.....

4.2.0 FORM D4*

TRAINING		PAGE 1 OF 2
EMPLOYEE'S NAME:		
EMPLOYEE'S SIGNATURE:		
POSITION:		
PERIOD OF EMPLOYMENT:		
TRAINING TOPICS	**COMMENTS**	**DATE AND SIGNATURE OF PLANT OWNER**
Understanding of hazards associated with Massa and the HACCP concept		
• Special tasks and unit operations • Millet cleaning • Washing of millet • Steeping • Milling • Aflata preparation • Dough preparation • Dough fermentation • Frying		

FORM D4*

TRAINING		PAGE 2 OF 2
TRAINING TOPICS	**COMMENTS**	**DATE AND SIGNATURE OF PLANT OWNER**
• Storage • Cleaning and disinfection • Good manufacturing practices • Good hygienic practices • Basic food hygiene		

4.2.1 FORM D5*

MANAGEMENT REVIEW	PAGE 1 OF 2
DATE OF REVIEW: **MEMBERS PRESENT AND SIGNATURES:**	
Last Management Review Report	
Last External audit report	
Verification reports	
Corrective actions report	
Customer complaints	

FORM D5*

MANAGEMENT REVIEW	PAGE 2 OF 2
Others	
Main conclusion	
Corrective actions and improvements instituted Persons responsible	
Date and signature of plant owner	

4.2.2 FORM D6*

LIST OF CURRENT DOCUMENTS				
DOCUMENT	DATE OF ISSUE	DATE OF LATEST REVISION	REVISION NUMBER	DISTRIBUTION

4.2.3 THE HACCP DATA SHEET

DATE:	REVISION NUMBER:	APPROVED BY:
PAGE 1 OF 2		

PROCESS STEP	CCP NO.	HAZARD TO BE CONTROLLED	CONTROL MEASURE(S)	CRITICAL LIMITS	MONITORING PROCEDURE(S)	MONITORING FREQUENCY	CORRECTIVE ACTION(S)	RESPONSIBLE PERSON(S)
Incoming raw material; Millet	1.0	Mycotoxin-producing moulds	Obtain certificate of analysis from suppliers	Aflatoxin <10mg/kg	Inspect certificate of analysis	Every batch	Reject batch	In-coming goods clerk, Supply QA manager
Incoming raw material; Water	2.0	Physical and microbiological contamination	Use clean water	Clean, clear and odourless	Visual inspection	Before every use	Boil and strain water before use	Line personnel
Steeping	3.0	Growth and proliferation of Pathogenic and spoilage microorganisms	Temperature and time control	< 30°C for 24hrs pH < 5.0 after 24hrs	Temperature and time records pH measurement	Every 4 hours	Steep longer	Line personnel

THE HACCP DATA SHEET (CONT.)

DATE:	REVISION NUMBER:	APPROVED BY:
PAGE 2 OF 2		

PROCESS STEP	CCP NO.	HAZARD TO BE CONTROLLED	CONTROL MEASURE(S)	CRITICAL LIMITS	MONITORING PROCEDURE(S)	MONITORING FREQUENCY	CORRECTIVE ACTION(S)	RESPONSIBLE PERSON(S)
Dough fermentation	4.0	Mycotoxin-producing moulds	Temperature and time control	< 30°C for 12hrs pH < 3.90	Temperature and time records pH measurement	Every 4hrs	Ferment longer Add a little of old fermented dough	Line personnel
Frying	5.0	Survival of existing microorganisms	Temperature and time records	Core temperature of 72°C for 2 minutes	Temperature and time records	Every batch	Adjust temperature and Fry longer	Line personnel

5.0 APPENDIX

PICTURES SHOWING THE PREPARATION OF MASSA

Picture 1..... The raw millet

Picture 2..... The milled millet

Picture 3..... Aflata preparation

* Forms D1 to D6 were adapted from Amoa-Awua W.K. et al (1998) *HACCP system for traditional African fermented foods: Kenkey.* WAITRO, Taastrup. ISBN: 87-90737-02-4.

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