

A TERM PAPER

ON

**FOOD PROCESSING AND PRESERVATION OF CEREALS IN SOUTHERN AND
NORTHERN NIGERIA**

BY

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CHAPTER ONE

INTRODUCTION

Food is essential to every human being as no man can do without it. Food is any nourishing substance that is eaten, drunk, or otherwise taken into the body to sustain life, provide energy, and promote growth. The knowledge of food is as old as the early men, as they also depended on food for their survival. As the early men gradually improved in different areas of their lives, their knowledge on food develop also developed. They started from wandering and picking food and fruits around, to stabilizing and having a shelter. Gradually, their knowledge of food started improving as they began to bring all forms of food to their surroundings by planting to make survival easier and less stressful than when they were wandering. As generations passed and population increased, new things were discovered in which new things about food were also discovered. They discovered that the increase in population was not equal to increase in food availability as stated by “The Malthusian theory of population” which examines the relationship between population growth and food supply. It states that the population grows geometrically, while its food supply only increases arithmetically, and this led to the increase in food production. Even after the increase in food production, they still discovered that this relationship was still not equal due to the high wastage of food because Agricultural produce are highly perishable, this now led to the preservation and processing of food. Some Agricultural produce are also seasonal, so preservation and processing of such produce was also very important.

Food preservation may be defined as the process of treating and handling food in such a way as to stop, control, or greatly slow down spoilage and, of course, to minimize the possibility of foodborne illness while maintaining the optimum nutritional value, texture, and flavour.

Food processing is a transformation practice in the beverage and food industry to make the raw foodstuff of animal and plant origin suitable for consumption (Meshram *et al.*, 2019)

Nigeria as a country in West Africa is very blessed. It has geopolitical zones, in which each zone is blessed with great soil for different crops. In as much as the production of these crops is important, the preservation and processing is also important. In Nigeria, different crops are produced varying from cereals to tubers but this term paper will focus on the preservation and processing of cereals in Southern and Northern Nigeria.

CHAPTER TWO

LITERATURE REVIEW.

Cereals are grains that are highly rich in carbohydrates. They include rice, wheat, millet, sorghum, barley, oats, and maize and so on, and each of them still has their various varieties which makes them unique. Cereal grains are considered to be one of the most important source of dietary protein, carbohydrates, vitamins, minerals and fibre for people all over the world (Blandino *et al.*, 2003). In Nigeria, cereals are produced in high quantity varying from millet in Northern Nigeria to maize in Southern Nigeria. In Nigeria, maize, sorghum, and millet are very important cash crops. They are consumed on a daily basis in different processed forms in diverse cultural backgrounds (Chilaka *et al.*, 2016). This term paper will ensure to discuss about the preservation and processing of cereals in Northern and Southern Nigeria.

PRESERVATION AND PROCESSING OF CEREALS IN NORTHERN NIGERIA.

In the Northern part of Nigeria, the cereals popularly grown are millet and guinea corn (sorghum). Although today, maize has displaced sorghum and millet from all but the most arid areas (FAO, 1992). Kebbi, Borno, Kano, Kaduna, Taraba and Benue states in Northern Nigeria also produce rice.

Preservation of Cereals in Northern Nigeria.

The grains highly produced in the North are sorghum and millet, and the preservation is very important to prevent wastage of the grains that can occur through spoilage or infestation of pests. The following are the ways the grains can be preserved:

1. **Mud rhombus:** A mud rhombus is a specially built structure made from a mixture of dry grass and clay. It consists of a bin resting on large stones and covered with a thatched roof plate. A mud rhombus consists basically the following:

- Foundation – floor assembly
- Shell or wall
- Roof



Loading of grains into mud rhombus is done by the removal of the roof, since no appropriate design for loading and unloading is included. The major crops found to be stored in the areas investigated are unthreshed millet and sorghum. It was learnt that the crop is stored for a minimum of two years and maximum of between seven and 10 years. The unthreshed crops are brought from the farm in bundles tied with ropes. The bundles are of same size with four bundles giving approximately 100kg of threshed grain, where the millet is to be stored for a duration of one year or less, the bundles are not loosened, but stacked in the rhombus where however, the storage is to be for a longer duration, the bundles are loosened and put into the bin by special arrangement carried out by 4 to 8 people depending on the size and the height of the rhombus. The first person stays on the ground, loosen the bundles and passes it to the 2nd person who is on top of the bin or on the ladder. The 3rd person who is inside the rhombus or on another ladder inside the rhombus collects the millet heads and together with the 4th person known as the ‘good hand’ arranges the millet heads in the structure. The man

referred to as the good hand is a person believed to be naturally disposed to storage, such that when he stores a product, minimum deterioration occurs compared to other people. In arranging the millet heads, the 'good hand' arranges them in a concentrically overlapping pattern, such that the millet are self-supporting in a way. After about 30 to 40cm depth of storage 3 to 5 other men climb into the structure and together with the 2 men already inside, the stored product is compressed. This procedure is continued until the bin is filled to the brim; the roof is then lifted and put in place. After about 3 to 4 weeks, the rhombus bin is inspected for settlement. Settlement is the settling of the stored millet mass by virtue of its self-weight resulting in both the reduction of depth of storage height and width. When about 5cm reduction in depth with a corresponding gap of about one to two centimetres between stored millet and rhombus shell is observed, the storage is considered good, the mouth of the bin is then sealed with a mud disc and the roof put in place. Unloading of the stored crop could sometimes become difficult and cumbersome because of the above loading procedure. In large capacity rhombus bin part of the shell may have to be broken to create an opening for easy off-loading, the created opening is later sealed after complete evaluation of stored products.

2. Underground Pit

This is commonly found in Borno and Yobe states where the water table is low. The pit, which may be round or square in cross section, is 1 – 3m deep and 1 – 3 m in diameter or square. The underground pit is usually lined with straw. The pit and the straw mat are padded with 40 – 60cm of corn husk. Also a layer of husk padding or insulation is provided at the bottom of the pit. The common types of grain stored are millet, sorghum and cowpea; they are stored in threshed form. The capacity ranges from 1000kg – 6000kg and above. After loading the grains into the pit, tree stems are placed across the pit then covered with polyethylene or metal sheet.



Then a layer of husk before finally layers of sand or laterite is used to cover it. The duration of storage could be between 1 and 5 years without opening and usually, once opened; all the content must be emptied. The same site can be used for up to 12 years with annual re-digging. The location of the defect is usually in the wall lining, which may be eaten up by termite, and the structure is not rodent proof. Maintenance is usually done by cleaning and replacement of the wall lining. Maintenance cost is dependent on the locality and availability of material.

3. Earthen Pot



The earthen pot storage is found in very few villages in Kaduna and Kano States. It is made of burnt clay. The shape and sizes differ with the locality. They have capacity of between 5 – 20kg of threshed or shelled cereals. The grains stored in this pot are used mainly for seedlings. The grain crops stored includes cowpea, maize and sorghum. The main defects are that, it is fragile, small in capacity and absorbs moisture from the ground where it is place. Damages on seed include mould growth, and spouting, change in colour, odour and taste.

Processing of Cereals in Northern Nigeria.

Processing the cereals also help in preserving the quality of the cereals and most importantly increases its usefulness. In Northern Nigeria, cereals are processed to different forms such as:

1. **Kunun-zaki**, an indigenous non-alcoholic beverage, is produced and widely consumed by adults and infants in the savannah region of Nigeria as a refreshing drink, an appetizer, a food complement and to quench thirst. It is also used as a substitute for or to complement soft drinks and wines at social gatherings. Kunun-zaki is prepared from either guinea corn (*Sorghum bicolor*), millet (*Pennisetum typhoides*) maize (*Zea mays*), rice (*Oryza sativa*) or wheat (*Triticum aestivum*). Traditionally, the production involves steeping of whole grains for 6–24h, wet milling with spices and sweet potato, gelling of about 3/4 of the mixture in hot water pitching with about 1/4 fresh (ungelled) part of the mixture and allowing for overnight fermentation. The supernatant is ready for consumption after sieving.
2. **Fura:** Pearl millet (*Pennisetum glaucum*) was obtained from Wadata ferment naturally at room temperature for 48h with occasional stirring of the mixture for proper aeration. The paste was molded into balls, steamed at 100°C for 1h. The balls were cooled, broken into small pieces and dried in a cabinet dryer at 60°C for 1h to about 7% moisture. The dried fura was milled with a hammer mill to flour of particle size of about 322µm, to give germinated and fermented instant fura (GFF). The second portion of the germinated flour, was steamed, dried and milled into flour to give germinated fura GF. Similar method as above was used to produce fermented fura, except that the grains were not germinated. Untreated fura was also produced following the traditional process.

3. **Tuwo Shinkafa:** Rice can be processed to Tuwo Shinkafa, the rice is boiled within very soft and then mashed together till it forms a solid shape, it is then eaten with any soup of choice.

PROCESSING AND PRESERVATION OF CEREALS IN SOUTHERN NIGERIA.

Maize is the most grown cereal in Southern Nigerian and therefore the cereal with the highest production in Southern Nigeria. Although today, maize has displaced sorghum and millet from all but the most arid areas (FAO, 1992).

Preservation of Cereals in Southern Nigeria.

Since maize is the most grown cereal, the preservation of maize in Southern Nigeria will be discussed.

1. Crib

The Crib is an improvement on platform structure, which is a rectangular shaped enclosed structure elevated between 0.5 and 1 m above ground, supported on columns and has well-ventilated sides made of straw, palm leaves, bamboo or wire netting. The entire storage structure could be constructed with wood, bamboo, metal or wire mesh and roofed with thatch straw or iron sheet and faced in such a way that the prevailing winds blow perpendicular to the length. The legs are fitted with rat-proof device to prevent rodent infestation. The Crib is designed in such a shape that the drying process continues during storage because of the free flow of air over the stored produce due to natural ventilation. Traditionally, the crib was used for unthreshed maize cobs storage but presently its use has been extended to include virtually many other crops. This type of storage unit is easy and cheap to make, but offers very little protection against insect pest and storage losses due to insects and rodents are often as high as 40%. Maize

varieties with husk are protected reasonably well for 3–6 months without the use of insecticides (Mijinyawa, 2002). Maize grain on the cob can be stored, safe from mould damage, in open-sided cribs. In this case, the moisture content need not be less than 13.5 per cent. Cobs can be loaded into the crib at high moisture content and allowed to dry by natural aeration. A drying and storage crib, used normally to store maize on the cob, can also be used to store shelled maize in bags. Pre-loading. Maize should be put in the crib only after the crib has been well cleaned and repaired.

2. Metal silo

Metal silos made from galvanized iron and recycled oil drums have emerged as efficient and low-cost storage containers for long-term storage of cereal grains and pulses in a water resistant and hermetic condition. Food grains stored in the metal silo are inaccessible by rodents, efficient against insects, sealed against entry of water, therefore, metal silos are excellent grain storage containers. However, they should be guarded against direct sunshine and other sources of heat to avoid condensation, they should be located in shaded and well-ventilated places (Adejumo, 2013). Hermetically sealed metal silos kill storage pests by oxygen deprivation without pesticides.

3. Storage bags

Short duration storage of food grains in sacks is widely used in farms, villages and commercial storage centers. Sacks made of woven jute, sisal, local grass, cotton and depend on the materials that are available in the area. These were earlier used widely in both Nigeria and India until the introduction of the polypropylene bags, however; farmers still use jute or sisal bags. They usually come in different sizes ranging from 25 kg bags to 100 kg bags. Polyethylene storage bags create a highly efficient, hermetic storage environment for all crops. Polyethylene bag is placed inside ordinary storage

bags for an additional layer of protection to form multi-layer polyethylene storage bags to ensure water resistant and completely air tight storage condition (Mutungi *et al.*, 2015; Ng'ang'a *et al.*, 2016). Maize can be stored in bags. The bags must be placed in an ordinary hut or a clean, cool grain hut. Mealies in bags can also be hung in a tree or strung between the branches of a tree. Stored grained insects can, however, fly and will damage the grain stored in the tree.

Processing of Cereals in Southern Nigeria.

Ogi: Ogi is a fermented cereal gruel processed from maize, although sorghum or millet are also employed as the substrate for fermentation. It is considered the most important weaning food for infants in West Africa although it is also consumed by adults (Banigo *et al.*, 1993). Along the West African coastal region the product is given other names such as eko, agidi, kamu, akamu, koko and furah depending on the substrate used and the form in which it is eaten. For the preparation of ogi, the cereal grains are steeped in earth ware, plastic or enamel pots for 1–3 days. Lactic acid bacteria, yeasts and moulds are responsible for the fermentation, although *Lactobacillus plantarium* is the predominant microorganism. Other bacteria such as *Corynebacterium* hydrolyse the corn starch, and then yeasts of the *Saccharomyces* and *Candida* species also contribute to flavour development (Caplice & Fitzgerald, 1999). The fermented grains are wet-milled and wetsieved to yield the ogi slurry (Iwasaki *et al.*, 1991). The nutritional qualities of ogi has been studied and it has been found that during the fermentation phosphorous is released from phytate (Lopez, Gordon, & Field, 1983) and niacin and riboflavin contents increase (Kuboye, 1985). However, approximately 20–50% of the nutrients available in the original cereal grains are lost through processing for ogi production, being the loss of aleurone layer and germ of grains during wet milling and wet sieving the reason for this (Adeyemi, 1983). Specifically, amino acid analysis of ogi and its raw materials indicate substantial losses

in lysine and tryptophan (Adeniji & Potter, 1978). To avoid these losses, lysine and methionine excreting mutants of *Lactobacillus* and yeasts have been used to fortify ogi (Odunfa & Oyewole, 1998;).

The colour of ogi depends on the cereal grain used: cream-white for maize, reddish brown for sorghum, and dirty grey for millet (Onyekwere *et al.*, 1993). Ogi has a sour flavour similar to that of yoghurt and a distinctive aroma, which makes it different from other known cereal-based fermented products (Chavan & Kadam, 1989).

Tuwo Agbado: Tuwo Agbado is processed from maize by grinding the maize into powder, in order to preserve the maize and prolong its life span. It can then be prepared into a solid food whenever and taken with any soup of choice.

CHAPTER THREE

CONCLUSION

In Nigeria, wastage of cereals is very high due to infestation of pests and this is caused by the inadequate storage and processing facilities. This makes most farmers practice traditional ways of preserving their cereals which is less effective. However, this could be lessened if storage and processing facilities are provided adequately, to prevent spoilage and prolong the lifespan of the cereals. The preservation and processing of cereals is beneficial to everyone as they are rich in carbohydrates which is the source of energy needed by everyone. The preserved and processed cereals can also be used to generate national revenue for the country through

exporting, this way the government can benefit from the provided facilities and also help to develop the country in which everyone benefits.

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