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TRADITIONAL METHODS OF FOOD PRESERVATION IN WEST AFRICA

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Abstract

Traditional food processing and preservation techniques form part of the culture of the people. It represents a vital body of indigenous knowledge, firmly rooted in the peoples' culture and is handed down from parents to children over several generations. The undervaluation of many of this indigenous knowledge has regrettably, led to the decline or loss of some of the traditional food products and food processing practices of West Africa. Sundrying, salting, in situ storage, fermentation, addition of natural antioxidants, storage in crates, smoking, soaking, frying, concentration, processing into meat products, packaging and storage in barns are age long traditional food preservation methods in west Africa. These methods are however limited by losses in protein, fats and vitamins, contamination with stones, pebbles and foreign materials and microbial infestation. Traditional processing techniques for food preservation are labor-intensive, inefficient and with low capacity. The slow progress in upgrading traditional food processing and preservation techniques is the main contributors to the high post-harvest loss and the resultant food and nutrition insecurity in the Sub region. Simple, low-cost, small-scale commercial food processing enterprises that evolve from indigenous knowledge of traditional food processing techniques are crucial to rural development and food security in West Africa. The success of which however, depended on adequate working capital, easy access to banks and other financial institutions, low interest rates and high profit margins.

Keywords: Traditional Methods, Food, Processing Techniques, Preservation, West Africa.

Introduction

Food preservation is the modification or processing of food to make safe and appealing products with uniformly high quality in terms of nutrition, texture and flavour. Preservation of food usually involves the prevention of natural spoilage processes such as the oxidation of fat (rancidity), enzymatic browning in apple, natural aging and ripening of fruits and discoloration. Preservation of food is culturally dependent as what qualifies as food fit for human in one culture may not qualify it in another culture. Depending on the food concerned, preservation may involve processing the food into another form thereby, creating intermediate or finished products.

Traditional technologies of food preservation date back thousands of years and long before modern high technology industries and scientific understanding of the inherent nature and consequences of these technologies involved (Hulse,1983).). Traditional foods and traditional food processing and preservation techniques form part of the culture of the people. It

represents a vital body of indigenous knowledge, firmly rooted in the peoples' culture and is handed down from parents to children over several generations.

Effective utilization of traditional preservation methods could significantly reduce the post harvest loses, consequently reducing the food insecurity (Mroso, 2003a). The common methods include drying, particle size reduction, soaking, cooking, frying, ashing, salting, concentration and combination of these methods to form products of improved shelf life. The undervaluation of many of this indigenous knowledge has regrettably, led to the loss of some of the traditional food products and food processing practices of West Africa. Preservation methods such as salting have declined in preference to newer methods that are machinery based, technologically advanced and sometimes energy intensive (Mroso, 2003a).

In the advanced nations food preservation methods like canning; freezing, freeze-drying, chemical additives, sterilization, irradiation, fumigation, genetic modifications and packaging systems have found wide use in commercial operation. These practices are also associated with a high consumer acceptability. The modern approach are however, not only capital intensive, they are technologically unsustainable in West Africa as machineries and spare parts has to be bought regularly with the dwindling foreign reserve. The present paper is a review of indigenous knowledge and practices on food preservation in the sub-Saharan Africa.

Indigenous preservation methods

Apart from the controversies on matters of technological sustainability as well as health and environment issues, the high input technological approach to food preservation are too sophisticated and expensive for the rural poor communities. Thus the most feasible approach to food preservation in West Africa is a low input technology that has low energy consumption, simpler machinery and storage at ambient temperatures. The age long alternatives that are affordable and sustainable. such as drying, salting, smoking or in combinations like smoking with drying or salting with smoking and drying and the use of herbs and spices including fermentation that are in common practice should form the bedrock for food preservation in the sub continent in the 21st Century. Traditional approach to food preservation is based on microbial manipulation in preventing spoilage or enhancing flavor, colour, texture and taste for a better final product with a long shelf-life Pace *et al.* (1989) investigated into several foods (herring, trigger, tilapia, and cassava) that were processed using traditional processing techniques in Ghana and observed that in most instances proximate nutrients and some vitamins and minerals increased due to loss of moisture. Consumption of the dried product also increased total nutrient intake for pregnant women and children who are nutritionally at risk.

Sundrying: Sun-drying is the oldest traditional method of food preservation in West Africa. The preservative principle in drying is the removal of moisture to inhibit enzyme and microbial activities during storage. Drying also reduces weight and bulkiness of food. West Africa being in the tropics is endowed with the sun, therefore, sun drying is traditionally carried out in all place. The suns' heat in the tropics is a renewable and sustainable energy source that is been widely used in drying and to driving fermentation processes. Sundrying is the most popular method of preserving vegetable and spices. The most important marketed

sundried foods in Ghana are vegetables (okro, tomatoes, shallots, leafy vegetables, fruits (plantain, bananas, palm fruits), nuts (bambara nuts and groundnuts), tuber (cassava, yam), spices (hot pepper, black pepper) (Yeboah, undated).

Drying of crop is usually carried out at the field of harvest, in some areas, maize cobs and stalks of other cereals may be hanged over a smoking unit usually a cooking spot within the family compound. Sometimes the unshelled grains are placed in between the ceiling and the roof for indirect impact of the sun. Wood fuel can be regenerated and renewed as biomass, for use in drying and smoking. Smoke drying (e.g. banda). This is employed to impart desirable sensory qualities, reduce moisture content and extend shelf life.

Salting: Salt is an abundant naturally occurring chemical can be used for curing. Salting is the addition of salt to food substances to prevent the growth of bacteria. Salting and drying prevent halophilic bacteria (salt tolerant bacteria). Food items such as fish are usually rubbed with salt or placed in alternate layers of fish and salt in a container.

In situ preservation: This is proven method in the preservation of yam and sweet potatoes. According to Msoro (2003b) the preservation and storage of both the root crop and the leaves ensures food supply to help during periods of food scarcity thereby enhancing food security. In western African countries more than 50% of the supply of calories is derived from the cultivation of roots and tubers (Okigbo, 1987).

Leaving of cassava roots in the soil after maturity is still widespread today. The roots can be kept in this way for several months without deteriorating and the rhythm of the harvest can be adapted to that of consumption (Annon). Freshly harvested roots may also be buried in the soil to preserve them. This is an adaptation of the earlier method of leaving ripe cassava roots un-harvested in the earth.

Fermentation: Fermentation is one of the oldest and most important traditional food preservation techniques which involve the use of microorganisms and enzymes for the production of foods with distinct quality attributes that are quite different from the original agricultural raw material. One of the most elaborate applications of fermentation in traditional food processing and preservation is in the conversion of cassava to *gari*. During fermentation, endogenous linamarase present in cassava roots hydrolyze linamarin and lotaustralin releasing HCN. Crushing of the tubers exposes the cyanogens which are located in the cell vacuole to the enzyme which is located on the outer cell membrane, facilitating their hydrolysis (Aworh, 2008). Most of the cyanide in cassava tubers is eliminated during the peeling, pressing and frying operations to a nutritionally safe level (FAO/WHO, 1991). Fermentation also helps to extend shelf life, inhibit spoilage and pathogenic microorganisms, impart desirable sensory qualities, improves nutritional value or digestibility. Traditional Nigerian fermented foods other than *gari* include *fufu, lafun, cassava chips, ogi, iru (dawadawa) and condiment such as ogiri (ogili), kpaye, ugba (Ukpaka), and drink such as burukutu/Pito/otika , shekete, agadagidi, fura-da-nono, kunu-da-nono and warankasi (soft cheese).* According to Okereke and Nwosu (1987) cassava and yams are usually processed into more shelf-stable products such as *garri* and *fufu* from cassava as well as yam chips and flour from yam to aid their preservation.

Addition of natural antioxidants: In many parts of West Africa, dry peppers are added to shelled grain to prevent insect re-infestation. Soybean is preserved in the pod unshelled and when shelled, it is kept in calabash, sacks and other clean container in a cool dry place. Some quantity of dry pepper may be added however, because of the smooth coat of soy beans, it is naturally preserved when stored in good environmental condition.

Storage in crates: Freshly harvested cassava roots can be stored in wooden crates lined with a layer of sawdust. The spaces between the roots are also filled with sawdust. Finally, the roots are then covered with sawdust.

Smoking: Smoking is the application of dry heat from a fire source to a food item. It is a common preservative practice among village or rural setting in Africa. Smoking is achieved by the use of burning fire wood without naked fire. The preserved food item is placed at a distance to the heat source to avoid it being roasted. The preservative principle is to reduce moisture content of the food item and prevent microbial and pest infestation. Meat chunks after boiling are exposed to smoke in earthen kiln or drum.

Soaking: Soaking is achieved by immersion of food item in water over a certain period of time. The method precludes some other preservative approaches. Soaking is essentially to remove some toxic substances that could reduce the shelf life of food item. A type of peas commonly called "pakala" in western Nigeria is usually preserved in this manner. However, the water is changed in every 3-5 days to reduce the problem of fermentation in the products. In Nigeria and Niger, the cheese is fried to preserve it. However, fresh cheese can be preserved in its whey protein for about to day when kept in a cool dry place. In Ghana storing fresh cassava roots in water is a widespread method on a household level and with traders. In many parts of West Africa roots which cannot be directly consumed or processed after the harvest are piled into heaps and watered daily. Storage periods using this method reached 2 months to 6 months depending on the quality of the root used.

Frying: Frying is usually done to alter the quality of food. It has a preservative effect as the heat destroys microorganism and enzymes, it also make the food surface dry. Food of moist interior such as fish and meat have relatively short shelf life owing to movement of moisture into the crust during storage, such foods in Africa are not usually produced for distribution but are used as snacks. They are fried until the centre is heated enough to destroy contaminating microbes. Foods that need to be supplemented with drying are fried at relatively low temperature to minimize colour and flavor change on the food item. Frying is dependent on time and processing temperature however, the time taken for food to be completely fried depends on food type, moisture content, sizes, texture and the method of frying(deep or shallow). The medium of frying is edible oil.

Concentration: This is the process of boiling off much water in liquid foods to reduce their volume and weight. The removal of water also increases the solid content thus preserving the products for few days. Concentration can be combined with other methods to improve shelf life of food. Over concentration may lead to localized burning and colour change. Ayib or wara is an unfermented cheese made by coagulating milk solids in buttermilk. It is common in Africa where dairy cattle are reared especially among the Fulani in the sub Saharan Africa.

Bacteria in the milk are destroyed by heating and recontamination is limited by the higher solid content after coagulation of milk solids. The shelf life of the cheese is extended by boiling it with matured stalk of brown sorghum which gives it the characteristic red colour. It is believed that tannins from the stalks has preservative properties. In Nigeria and Niger, the cheese are fried to preserve it. However, fresh cheese can be preserved in its whey protein for about to day when kept in a cool dry place.

Packaging: Packaging extends the shelf life of food items allowing them to be distributed to more distant markets. In Africa, foods are wrapped in simple material such as leaves of plantain, cocoyam believed to have some antibacterial substances to prevent spoilage. Solid pap made from cereal and "fufu" made from cassava among others are usually wrapped in leaves to extend their shelf life. Maize may be processed into pap which is then concentrated to form a semisolid substance called *eko* in Nigeria. This pap is packaged in leaves of banana which is believed to contain some antibacterial properties

Figure 1:Yam Ban in South-West Nigeria.

Dried maize stored with the cob may be further shelled and stored in air tight containers and regularly placed in the sun over an extended period of time. The moisture content of dry grains is measured by the application of pressure to the grain with teeth or thumbnail. Legume peas are usually stored in air tight container which frequently positioned in the sun or at close distance to burning wood. Paste is formed from pepper alone or in combination with other fruits such as tomatoes. The pepper is first ground and then heated up to concentrate the paste. The heat destroys enzymes and contaminating microorganism. The paste is poured while it is still hot into clean tins or bottle glass of different sizes depending on the need per time. Hot oil is poured over the paste to form a thin layer at the surface to prevent air from entering the paste. The cover or lid of the tin is then ceiled with a thin later of candle wax to further exclude air. Paste preserved in this manner can store a long time as long as it is not

opened. It should be noted that the whole content in tin would have to be used once it is opened. Palm oil is packaged in plastic kegs and placed over a platform or over uncemented floors. Palm oil is also preserved by the addition of about 10grammes of common salt (sodium chloride) before storage. In certain local communities like Ogbomosho in Nigeria, the oil is poured into a big clay pot and placed in a dug pit and covered with sand. Oil preserved in this way can be kept for months without loss of quality. In another instance, little quantity of solid pap made from maize is churn into paste and thoroughly mixed with the oil to prevent rancidity. In practice, suitable storage container such as glass, bottles made from colored glass or kept in a dark box, metal oil cans, where the metal is tin coated, glazed ceramic pot sealed with a cock.

Figure 2: Dried Plantain chips in South-West Nigeria.

Storage in Barns: Augustin and Simeon (1990) carried out an inventory of traditional yam preservation techniques in various regional agricultural production centres in Burkina Faso. They observed four major storage structures which are: (1) a conical silo made of millet stems; (2) a pit of various shapes depending on the CRPA; (3) a grain silo, used mainly in the eastern part of the country, and (4) a hangar built with tree branches, with a larger storage capacity.

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Figure3: Traditional grain silo.

Processed Meat products: Processed meat products in West Africa include *banda, suya, kilishi, ndariko* and *jirge*. These products vary in the shelf-life and the type of meat used in preparing them. Banda is a salted, smoke-dried meat product made from chunks of cheap, low quality meat from horses, camel, buffalo and wild life (Obanu, 1987). Unlike *banda, suya* and *kilishi* are usually made by roasting spiced, salted slices/strips of usually beef. *Kilishi* differs from *suya* (see Figure 3) in that a two-stage sun-drying process precedes roasting. Consequently, *kilishi* has lower moisture content (6-14 %) than suya (25-35 %) and a longer shelf life. A variety of spices and other dried ingredients are used in *kilishi* (Aworh, 2008). *Ndariko* and *jirge* are made by sun drying long strips of meat with or without the addition of salt and spices, however the meat for *jirge* is first allowed to ferment to develop the desired sour taste before sun drying.

Figure 3: Traditional suya prepared from meat

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Limitations of traditional methods of preservation

It is estimated that about 50% of perishable food commodities including fruits, vegetables, roots and tubers and about 30% of food grains including maize, sorghum, millet, rice and cowpeas are lost after harvest in West Africa. Aworh (2008) identified ineffective or inappropriate food processing technologies and the slow progress in upgrading traditional food processing and preservation techniques as main contributors to the high post-harvest loss and the resultant food and nutrition insecurity in the region. Lyimo *et al.* (1991) investigated the effect of traditional food processing, preservation and storage methods on vegetable nutrients was studied using cassava, pumpkin and *mwage* leaves. The observed that traditional cooking method for 90 min for cassava, 50 min for pumpkin and *mwage* leaves resulted in significant losses in protein, fats and vitamins while Sundrying using traditional mats caused losses of vitamin A of 36.3%, 38.0% and 50.3% for cassava pumpkin and *mwage* leaves respectively and Storage using earthenware pots for six weeks resulted in significant losses of vitamin. Okereke and Nwosu (1987) reported that all the various traditional methods for storage of maize, cassava and yam in the southern part of Nigeria led to storage losses both quantitatively and qualitatively due to microbial infestation. Aworh. (1993) investigated the various processing techniques involved in traditional preservation such as threshing, winnowing, dehulling, peeling, dry milling, wet milling, roasting, boiling, parboiling, sundrying and smoke drying and reported that traditional techniques involved in processing food for preservation are labor-intensive, inefficient and with low capacity. Sun-dried products are often of low quality because of contamination with stones, pebbles and foreign materials (see Figure 4).

Figure 4: drying of cassava flour. Contamination with pebbles is possible under this system

The traditional preparation of *ogi* involves steeping cereals such as maize, millet or sorghum in water for 1-2 days, followed by wet-milling, wet-sieving and fermentation for 2-3 days, there is however a considerable nutrient loss during *ogi* manufacture and depending on the processing method used, protein losses may be as high as 50% (Akingbala *et al.*, 1981; Oke and

Nwosu, 1984). Storing of cassava root in soil has the danger of roots being infested by pathogens. It may also result in the loss of nutrients. The root also become woody and impairments to the flavour occur (Anon). The major problems of sun-drying in Ghana according to Yeboah (undated) are contamination and uneven drying aggravating post-harvest loss to as much as 50%. Laboratory study has also revealed that the spices used for processing products such as suya and kilishi are potentially sources of microbial contamination. Microbial populations including coliforms in meat products exceeding acceptable limits for ready-to-eat meat products and the presence of a wide spectrum of pathogenic bacteria have been reported in retail suya (Igene and Abulu, 1984). These submissions suggest the need to further improve storage conditions for these crops. The need to direct research effort at improving the wholesomeness safety and shelf life of traditional processed meats through the upgrading of the traditional technology and the control of microbial contamination is imperative. This will also help to allay consumer concern as revealed by a consumer surveys (Igene and Mohammed, 1983).

Upgrading of traditional preservation techniques and the Development of small-scale commercial food processing enterprises

Simple, low-cost, small-scale commercial food processing enterprises that evolve from indigenous knowledge of traditional food processing techniques are crucial to rural development in West Africa. It is vital to reducing post-harvest food losses and increasing food availability, generate employment opportunities in the rural areas and reduce rural-urban migration and the associated social problems (Aworh, 2008). Full-scale mechanization, even when technically feasible, is not always economically justifiable as experiences with large, fully mechanized cassava processing plants in Nigeria have shown (Akinrele *et al*., 1971). Full mechanization often results in higher overhead costs. Small scale commercial food preservation industries that is based on the traditional knowledge of food processing that has the possibilities for replication in the rural areas where the raw materials are produced, offer better prospects for success Aworh (2008). One great challenge to food scientists and technologists today is modernization of the processes and equipment while still retaining the traditional attributes of the food products crucial to consumer acceptance (Sanni, 1993). Some of the successes recorded so far in the upgrading of traditional African food processing technologies including the mechanization of *gari* (fermented cassava meal) processing, the production of instant yam flour or flakes, the production of *soy-ogi* (a protein-enriched complementary food), the industrial production of *dawadawa* (a fermented condiment), the upgrading of the *kilishi* (a traditional roasted dry meat product) process and the traditional West African cheese-making process (Aworh, 2008). An upgraded traditional process for the production of *ogi* powder which involved wet-milling, wet-sieving with gyrating shaker and sieves, fermenting, de-watering with a screw press, followed by drying in a cabinet dryer, milling, sieving and packaging is particularly suited for production at community level have been developed (Adeyemi, 1987). The process involved in the traditional preparation of cheese from milk is very unhygienic and there are no quality standards. The quality of the product is highly variable and often very poor. An improved cheese-making procedure based on the traditional process has been developed (Aworh *et al.,* 1994). Commercial application of this improved procedure will help to improve the storability and nutrient quality of milk products. A model pilot plant for improved processing of *kilishi* was established in Benin City, (Nigeria) as a collaborative research project between Wilberforce University, USA and the

University of Benin, Nigeria with fund provided by the United States Agency for International Development (USAID)/the United Negro College Fund Special Programs (UNCFSP) and the Raw Materials Research and Development Council of Nigeria. The plant used improved technology involving cabinet (tray) drying and vacuum packaging to upgrade traditional food processing technologies to produce meat products with improved quality, shelf life, consumer acceptance, export potential and income generation (Ahmadu *et al.*, 2004). This novel plant need direct investment of the private sector for its commercial application. A viable alternative to traditional sun-drying is solar drying. The Food Research Institute of the Council for Scientific and Industrial Research of Ghana is undertaking a research in the modernization of the processes and equipment of food products while still retaining the traditional attributes crucial to consumer acceptance (Sanni, 1993). The success of small scale enterprises for food preservation is however hinged on adequate working capital, easy access to banks and other financial institutions, low interest rates and high profit margins.

CONCLUSION

Traditional food processing and preservation techniques are critical components of the culture of the West African people. In the light of modern scientific variables, these indigenous approaches have continued to thrive. This explains that the sustainability it enjoys is rooted in the gains it yields for the people. It is understood that there could be need for improvements but given the system as it is today, such advancements may not come easy.

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