



Jam making and packaging in Nigeria, Sub-Sahara Africa: A review

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ABSTRACT

During the period of fruit glut, a considerable quantity of fresh fruits get easily spoilt and thrown away due to the highly perishable nature of the commodity. Several methods abound to process fresh fruits into products that are much more shelf-stable and available all year round. One of such method is processing of the fruit in high sugar content to obtain a fruit preserve like Jam. This paper reviews the current practices in local Jam making and the challenge of easy availability of adequate appropriate packaging for commercial production of Jam in developing economy like Nigeria, wherein small scale producers cannot easily afford the usual foreign glass jars that are mostly used by large corporations. It also highlights the need for exploration of other possible available local packages that can be adopted successfully for commercial purposes.

Keywords: Jam making, Packaging, Nigeria

INTRODUCTION

Food security is a global issue that has been lingering till date. There has been great clamouring for adequate agricultural food production and utilization to sustain the world's estimated 7.6 billion people (as of June 2017 United Nations estimation). However, the problem of getting enough food at all times is not limited to agricultural production only (Khatoon et al., 2015), as a lot of foods still get lost along the food value chain (Huston, 2017), despite the overwhelming degree of hunger that bedevils a great number of poverty-stricken population of poor nations. This loss of food is either due to deliberate action of food wastage by affluent people, evitable handling/processing operation losses (Jedermann et al., 2014), or losses incurred as a result of the perishability (Khatoon et al., 2015) of many agricultural foods.

Fresh fruits and vegetables top the list of most perishable agricultural food commodities as a result of their high moisture content in conjunction with various readily available nutrients/growth factors (Singh, 2007; Arah et al., 2016). Consequently, these commodities are often preserved in high sugar and/or salt solutions to extend their shelf-life (Food Safety Authority of Ireland, 2017)

or add variety to common food products. One of such methods of preserving fruits is by processing into Jam (Jain, 2017). Jam making is an act and art (Borah, 2017) of preserving different types of fruits (and some vegetables) in high sugar syrup. The process relies on the preservative effect of sugar in high concentration that tends to make moisture unavailable (Rawat, 2015) for the proliferation of microorganisms (especially bacteria) and thus inhibit their growth in the food product, thereby extending the shelf-life of the food. The Jam is usually hot-filled into sterilized glass jars that are inverted after capping (Adebayo and AbdusSalam, 2017) and then allowed to cool and set in upright position for subsequent storage.

Meanwhile, the problem of local availability of appropriate packaging materials has been hindering local production (Omah and Oba, 2017) of the preserve for commercial purposes in a developing nation like Nigeria. The glass jars that are usually adopted for Jam packaging are imported from companies like Mark and Spencer in United Kingdom, and Zapetti in France (Africa Processing, 2017). These foreign packages are not usually easily accessible and affordable to local producers, in spite of the fact that Jam production can be done in as small scale level as the home kitchen with

minimal available tools. Hence, this paper aims to review the current trend and enumerate possible prospects in Jam making and packaging in Nigeria. The review could serve as a useful step in suggesting proactive measures that could help in addressing the situation, so that more small scale manufacturers with the appropriate technological know-how could venture into increased commercial production for wealth creation.

The challenges of fruit loss and wastage in Nigeria

From the popular Mile 12 market in Lagos (South-western Nigeria) where many truckloads of fruits and vegetables get rotten even before being offloaded, through the Orange market in Abuja (North-central Nigeria) where heaps of rotten and discarded fruits are dumped by the roadside and other strategic spots, to the Naibawa Yan Lemo market in Kano (core Northern Nigeria) where only the concerted efforts of the incumbent State Government on environmental sanitation helped in curtailing the hitherto bad aesthetic characteristics of the market's rotten fruits dumpsites; the stories of great wastages and losses of fresh fruits are all similar in different parts of Nigeria considering its great challenge of low infrastructural/storage facilities. In fact, in the year 2016, the Agricultural Fresh Produce Growers and Exporters Association of Nigeria (AFPGEAN) gave a press statement that between 55 to 72% of fresh produce grown in the country perish before they can be consumed.

These great losses are consequent upon the fact that after harvest, micro-organisms and naturally occurring enzymes rapidly change the colour, flavour and texture of fruits and vegetables (Rawat, 2015). The speed varies with different types of crop, but, compared to other crops (such as cereals), there is a limited amount of time available before fruits and vegetables must be processed. Another problem that face fruit and vegetable operators is that most of them are seasonal; for a business to operate throughout the year, crops must be either part-processed for temporary storage, or a succession of crops must be processed as they come into season (United Nations Industrial Development Organization, UNIDO, 2004).

Subsequently, various processing methods are adopted to convert surplus fruits in time of glut into value-added products that will outlast the seasonal fruits. These techniques include production of high-sugar preserves (jam, jelly and marmalade), fruit juice, nectar, puree, concentrates, pickle, dried chips and more advanced crystallized fruit sweets. Many of these processes can be done on a small/medium scale level while the more advanced ones require more sophisticated machinery and set-up.

Jam making practices in Nigeria

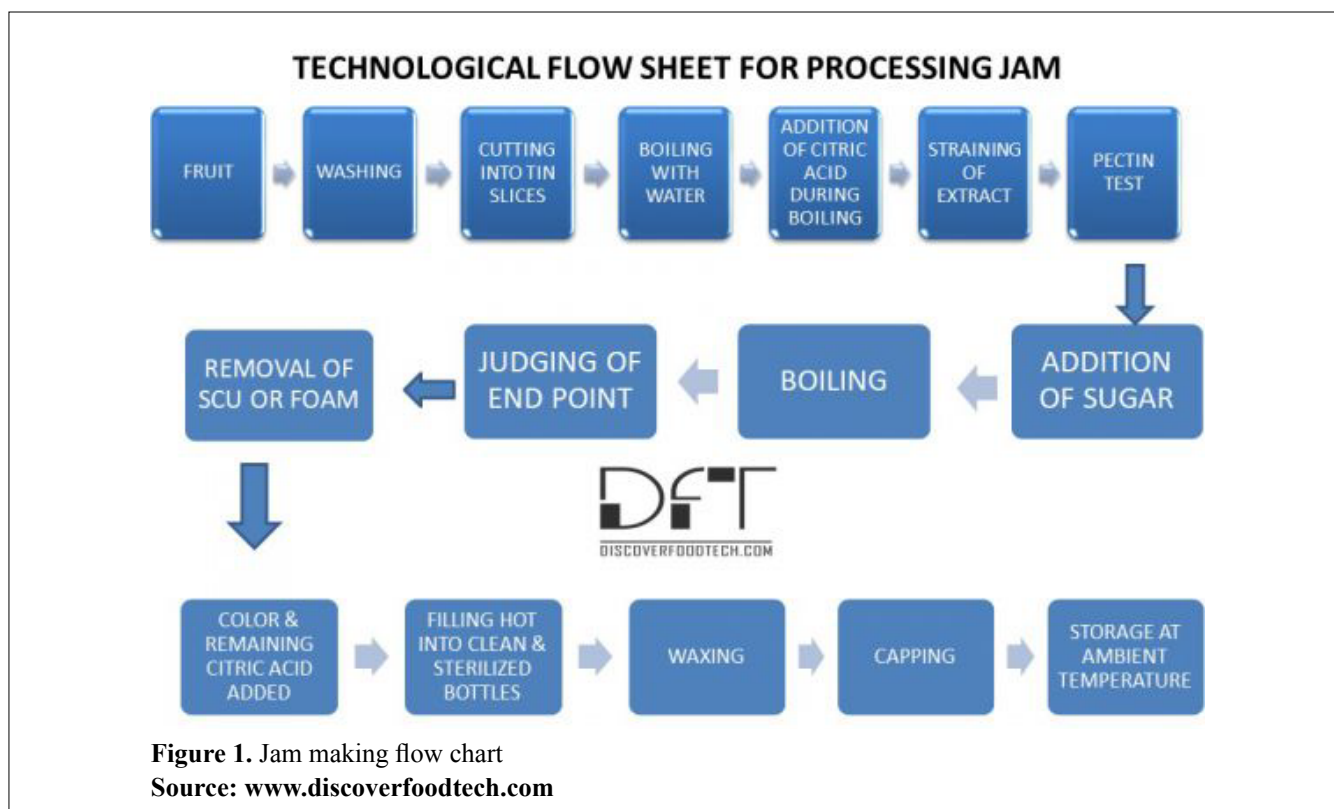
According to Herbstreith and Fox (2011), making jams and

the other preserves by using fruits, sugar, pectin and edible acids is one of the oldest food preserving processes known to mankind and presents a way of making food stable by increasing the total soluble solids (TSS) content. The final TSS should be about 65% to 69%. High sugar content are adopted in Jam making in order to suppress microbial growth, sweeten the product, help set the pectin, and make the product glisten (Bourne, 2007), while the pectin precipitates and helps form a matrix (gel) with the fruit content (and sugar) to yield a mixture that has a shelf-life of over 6-12 months.

The act and art of Jam making is an interesting process that help reduce post-harvest losses that are often associated with fresh fruits (Jain, 2017). Virtually all types of fruits and some vegetables could be made into Jam. The processing could be attained with minimal tools as long as there is adequate technological know-how to manipulate the appropriate parameters that are involved in the operation. Figure 1 depicts a flow chart of the general steps that can be adapted in Jam-making.

Many students of Food-related courses in the higher academic institutions in Nigeria are taught the act of Jam making that has now become an enjoyable art, as many creative flavourful combinations of fruits and vegetables are being adopted in the processing. Various Nigerian researchers have conducted different scientific works on Jam. These include Adebayo and AbdusSalam (2017) that conducted comparative studies on mixed fruit jam packaged in different local containers, Isah (2017) who studied the physicochemical, sensory and microbiological properties of syrup and jam prepared from locust bean fruit pulp in storage, Usman (2017) who evaluated gelling properties of pectin from local guava and orange fruits, Fasogbon *et al.* (2013) that studied the physico-sensory characteristics of jam from osmotically-dehydrated pineapple fruits, Ajenifujah-Solebo and Aina (2011) whereby the possibility of using Black plum fruit (*Vitex doniana*) to produce jam was explored, Ndabikunze *et al.* (2011) that tested the possibility of using high-gelling baobab powder as substitute for commercial pectin in production of jam, and Olakunle (2011) that worked on the production and evaluation of Jam from roselle calyx extract.

In addition, a lot of interested households and commercial kitchens have taken to small-scale production of Jam that is packaged in cleaned used glass jars. The resulting products are usually uploaded unto blog pages and social media by those involved in their manufacture. This growing interest in Jam-making is a positive approach to help address fruit losses that are characteristics of on-season period of the commodity. Following the build-up of interest in the product manufacture, it has become necessary that attempts be made to make affordable and accessible packages available for adequate proper extended storage life in order to make more meaningful economic impact in the country.



Packaging of Jam in Nigeria

Generally, packaging serves important functions that include preserving, protecting, marketing and distributing foods (Raheem, 2012). Packaging materials can be broken down into different kinds of glass, laminates, metal, plastics and paperboard (IFT, 2007). Out of these, about 60% are utilized for the food and beverage industry (Haverkamp, 2007). Paper and paperboard is said to be the largest (~34%) consumer packaging category followed by plastics with approximately 27% (EYG, 2013; Kirwan et al., 2011). In Malaysia, plastics and glass are the major materials used for food and beverage packaging by almost all small and medium enterprises - SMEs (Hicks, 2004), since these packaging materials are very popular, easy to use, cheaper, and easily available out there. Similarly in Nigeria, most of SMEs extensively use plastics for packing food and beverages (ReportLinker, 2016); while their use of glass is limited to collected used/recycled glass receptacles (Market Survey by the Authors, 2018). The use of plastic and glass also eliminated a need for sophisticated machinery as packaging can be done manually. In addition, Adejumo and Ola (2008) observed that Nigerian food vendors locally packaged a large proportion of ready-to-eat products in soft or flexible materials including broad leaves, paper and plastic film wraps. Glass-sided boxes, cane baskets and jutes or woven sacks are also used in the bulk packaging (Adejumo and Ola, 2008) of some solid food items.

Although packaging is one of several factors for consideration by a prospective processed food producer, it can sometimes determine the scope and method of production of specific foods for sale in the small-scale setting. Also, as noted by Paltrinieri (2017), the packaging can likely be the main cost involved in production. This could be as a result of the challenge of easy and cheap availability of the right kind, types and units of packaging receptacles in developing countries like Nigeria (Omah and Oba, 2017), which have now made packaging factor to assume great importance amongst other factors to be accounted for in setting up a small/medium scale processed food factory. In any case, IFT (2007) highlighted that the right selection of packaging materials and technologies assures product quality and wholesomeness during distribution and storage.

Subsequently, similar challenge affects the growth of small scale production of fruit preserves in Nigeria. The preference of glass jar for hot-filled food products like Jam is due to its inertness, that is, glass does not react with the high-acid food contained in it (Smith and Gifford, 2007) and impermeability to moisture and other nuisance that could contaminate the product. However, an average local producer cannot easily afford imported new jars and thus often collects used glass jars (Adejumo and Ola, 2008) or any other similar re-usable containers for proper cleaning/disinfecting and subsequent re-using for the packaging of the Jam. This option appears to be easier and cheaper to such local manufacturer than to order for the much more expensive new foreign jars that are

used by large-scale producers. Currently in Nigeria, there are a few local glass bottles manufacturing companies that produce new bottles for some food drinks, but, they are yet to successfully manufacture the type of glass receptacles that are required for Jam packaging.

Also usable for Jam packaging are earthenware/pottery containers. The use of pottery containers by small-scale producers results from the fact that such receptacles are often low-cost (Adejumo and Ola, 2008) and are locally obtainable alternative to glass. Meanwhile, in the developed nations like Europe, glazed pottery containers are used to pack high value, luxury foods such as very expensive marmalade, meat paste and cheese (Fellows and Axtell, 1993). Correctly glazing the earthenware can make them much more suitable for Jam packaging, as such glazed pots are very resistant to chemical attacks (Silva et al., 2012), have low permeability to moisture (Harper, 2012) and gases, and have little interaction with the product contained within it. Acceptable sealing methods for pottery packaged food products include use of cork bung (around which sealing wax is coated), use of pottery insert and disc of polythene, and waxed paper or polythene held on with rubber band or string (Fellows and Axtell, 1993). Figure 2 shows Jam packages that are cloth covered and held with strings.

More so, large scale manufacturers are increasingly packaging their products in pots with aluminum foil lids; and these packs are becoming popular with urban consumers as they are cheaper and more convenient than glass (Fellows and Hampton, 1992).

A much cheaper alternative to the aforementioned packages for Jam and other food products are flexible plastic containments. These are very readily available in Nigeria for the small scale producers. These are also easily sealable manually with as simple as candle light or better still with electric hand sealers that are quite affordable. A study conducted on the use of local containers for packaging Jam by these authors (Adebayo and AbdusSalam,

2017) successfully adopted plastic pouches and sachets for packaging of Jam for a long period of storage at ambient room temperature. However, the use of plastics necessitate that technical advice should be sought to ensure that only those that are food grade are utilized.

Technically, the general packaging requirement for Jam and other sugar preserves is medium priority due to their high acidity and relatively low moisture content which make them self-preserving and safe from causing food poisoning (Fellows and Axtell, 1993). The pack is to act as barrier against moisture entry to prevent Jam from mould and yeast growth. An ideal packaging should be appropriate for its contents, has very little or no interaction with its contents, use the minimum materials, be easily affordable and should be environmentally friendly.

Prospects of local packages in commercial production of Jam in Nigeria

Small and medium scale enterprises play very important roles in the growth and development of Nigerian economy (Anigbogu, 2014). Thus, various attempts to make production and distribution easier for such are highly needed. The study conducted on the use of local containers for packaging Jam (Adebayo and AbdusSalam, 2017) offered an eye-opening opportunity for the exploration of available local packages for commercial Jam production.

Plastic containers, pouches and sachets offer cheap, clean alternative to the glass jars that are usually used for Jam packaging. However, it is noteworthy to state that most plastic packages cannot be used at high temperatures. In the case of Jam, the product has to be allowed to cool to below about 60 °C before filling, and it also require that a slow-setting pectin should be used so that the pectin does not set until the product has cooled (Fellows and Axtell, 1993). Another constraint to use of plastics is that a wide range of different types and mixtures of plastics are used to make many containers that are not suitable for contact with food, as they contain chemicals (plasticizers) that are toxic and can migrate from the plastic to the foods (oily foods are particularly likely to dissolve plasticizers).

Hence, the food manufacturer must make certain that the type of plastic being used to make the container is food grade.

CONCLUSION AND RECOMMENDATIONS

The establishment and successful operation of small-scale food processing enterprises face several constraints that include unavailable adequate packages. Plastics and used/recycled glass containers are the major materials used for food and beverage packaging by small-scale food processors in Nigeria. These receptacles are also applicable to Jam packaging, provided all necessary precautions are observed.



Figure 2. Cloth-covered Jam packages

Thus, it is recommended that various relevant government agencies that are saddled with the responsibilities of developing SMEs, conducting science and technology research and development, and so on, should consolidate on their efforts to identify and ascertain the appropriateness of the locally available packages for hot-filled foods like Jam, so that the producers can be better informed in making right choices of such receptacles for the commercialization of their products.

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