Journal of Agricultural and Veterinary Sciences *Volume 2, September 2010*

AN APPRAISAL OF GARI PACKAGING IN OGBOMOSO, SOUTHWESTERN NIGERIA

**** Adejumo, B. A. and A. O. Raji *****
****Department of Agricultural Engineering, Ladoke Akintola University of Technology, Ogbomoso***
***** Department of Agricultural and Environmental Engineering, University of Ibadan, Nigeria***
Email: funmibitan@yahoo.com;bolanleadejumo@yahoo.com

ABSTRACT

An appraisal of gari packaging and sale in ogbomoso, Nigeria is reported. The objectives of this work is to appraise the various packaging materials used for gari and to suggest safe, appropriate and affordable packaging materials for gari packaging and storage. This is with the aim of reducing losses during storage and for proper planning of marketing strategies in terms of product packaging. The study was carried out by administering structured questionnaire combined with personal interviews with producers and marketers. A total of 50 respondents consisting of 35 marketers and 15 producers were interviewed. The results showed that the packaging materials used for gari packaging are all improvised material not specifically made for gari packaging. Ninety-six percent (96%) of the respondents uses hessian bags, 1% polyethylene bags while 2% combine hessian and polyethylene bags for the packaging of gari. Ninety percent (90%) of the respondent stored gari for between 1-6 months, 8% for 6-12 months while 2% stored for above 12 months in hessian bags. The percentage loss of gari during storage ranges between 3-10% for the packaging methods assessed which is a function of the type of storage materials used, storage conditions, storage duration and the quality of the gari before storage. The losses were in terms of change in colour, odour and taste. Ninety-five percent (95%) of the respondent retail gari from open containers, 4% from mats and 1% in 50kg bags usually wholesalers. It was observed that the problem of poor keeping quality of many dehydrated foods such as gari in the tropics is related to their moisture uptake during merchandising. This is perhaps due to poor packaging materials and the levels of moisture at which they are prepared and exposed. The use of plastic packaging bags cannot be overemphasized. There is therefore the need for further studies into the appropriate storage and packaging materials for gari as regards its physicochemical qualities as well as its protection against contaminants and increased shelf life.

Keywords: Gari, hessian bags, jute bags, packaging, losses, storage.

INTRODUCTION

Cassava roots are good energy source, containing high quantities of carbohydrate and water. The protein and minerals contents in cassava are small, while the dry matter content of the fresh root is about 40% (Kwatia 1986). Cassava roots consist of a fibrous peel (10–15% of tuber weight) and a core, which is the main region for starch (IITA, 1990). The normal cyanogens content of cassava tubers varies between 15 and 400mg HCN per kilogram fresh weight (Opara, 2002). Traditionally, cassava roots are processed by a variety of methods into different food products depending on locally available processing resources, local customs and preference. Processing of cassava roots affects the biochemical contents of the resulting products such as gari and flour (Kemdirim *et al.*, 1995).

Gari is the most commonly used form of cassava products in Nigeria and it accounts for 70% of the entire cassava production in Nigeria (IITA, 1990). It has been estimated that between 4 and 5 million tonnes of cassava roots are used each year for this purpose. Other products such as fufu, lafun, starch, pellets, chips and cassava flour and the raw root constitute the remaining 10–11 million tones. In the production of gari, fresh cassava roots are peeled, washed and grated. The grated pulp is packed in sacks (Jute or polypropylene) and placed under heavy stones or pressed with a hydraulic jack between wooden platforms for 3-4 days to express excess liquid from the pulp while it is fermenting.

Fermentation imparts an acidic taste to the final product (Hahn, 1992). The dewatered and fermented lumps of pulp are crumbled by hand and most of the fibrous matter is removed. The remaining mass is sieved with traditional sieves (made of woven splinters of cane) or iron or polyethylene mesh. After being sieved, the fine pulp is then roasted in an iron pan or earthen pot over a fire. If the sieved pulp is too wet, it takes longer time to roast resulting in a finished lumpy product with dull colour. Palm oil may be added to prevent the pulp from burning during roasting and to give a light yellow colour to the gari. When palm oil is not added a white gari is produced. Palm oil contains substantial quantities of vitamin A; therefore, yellow gari is 10-30 percent more nutritious and expensive than white gari.

The garification or conversion rate of fresh roots into gari is between 15 to 20%. This value varies with cassava varieties, time of harvesting, age of plant and other environmental factors. In general garification reduces moisture content to about 8 to 10%. The low moisture content gives gari a good shelf-life. One of the very important quality attributes of gari is the swelling capacity in water, which should be at least three times the initial volume of dry grits. The proximate composition of a typical village gari in Nigeria as reported by FAO (1994) shows that gari consists of 81.8% weight of carbohydrate, 14.4% water, 1.4% weight crude fiber and 0.9% of crude protein. Particle size of gari ranges from below 50 µm (fine) to over 200 µm (coarse). In practice the quality of gari is judged by the degree of coarseness and moisture content (Bencini, 1991). Free-flowing, granular meal and creamy-white color (or yellow if palm oil is added) are the attributes of good gari.

Gari produced in Nigeria are usually packaged and stored in hessian bags. The products are sold from open containers, polyethylene sheets or mats using small measures. It has been recognized that certain bottlenecks exist particularly in the packaging of products emanating from cassava roots. In line with this the solution to the problem of packaging had been suggested to be polyethylene bag (Oyelade, 2005), however little success has been recorded in the use of polyethylene bags in the storage of gari due to the high water activity of the product during storage (Sanni,1996). Polyethylene is widely used as a packaging material because of its good mechanical properties and low cost. However, these qualities have been overshadowed by its high non-biodegradable nature, this leads to waste disposal problems, particularly in short-term packaging applications (Sailaja and Chanda, 2000).

The objectives of this work is to appraise the various packaging materials used for gari and to suggest safe, appropriate and affordable packaging materials for gari packaging and storage by the local producers. This is with the aim of reducing losses during storage and for proper planning of marketing strategies in terms of product packaging.

MATERIALS AND METHODS

A survey was carried out on the various types of packaging materials and the storage methods used for gari in Ogbomoso town. The study was carried out by administering structured questionnaires combined with personal interviews. The questionnaires were administered to producers and marketers. This is with a view to know the types and causes of losses incurred on the product as a result of the packaging method and material. Personal interviews were conducted because most of the producers and marketer involved in gari packaging and storage are illiterates and low income category who may not value nor consider filling questionnaires as been important. The parameters investigated were:

(a) Types of packaging materials in use
(b) Effects of the packaging materials on stored gari
(c) Quantity stored and duration
(d) Losses in storage

The data collected through the questionnaires and interviews were analysed using rank and percentile statistical methods on the types of packaging materials, its effects on the products, losses incurred during storage and the causes of losses. A total of 50 respondents consisting of 35 marketers and 15 producers were interviewed. The markets are Sabo, Arada, Akande, Iresa-apa and Odo-Oba and gari processing sites located within and around Ogbomoso town, southwestern Nigeria.

RESULTS AND DISCUSSION

Types of Packaging Materials used for Gari Packaging

The results showed that all the packaging materials used for gari packaging are all improvised material not specifically made for gari packaging (Plate 1). They include old hessian bag of sugar, flour, fertilizer, rice, etc. The producers and marketers of gari in all the places visited stored and packaged this product in hessian bags with only a few using jute and transparent plastic polyethylene bags this is in conformity with the report of Oyelade *et al*. (2001). The survey showed the use of hessian bags by 96% of the local producers and marketers for the packaging of gari while 1% use polyethylene bags and 2% combine hessian and polyethylene bags (Figure 1). Hessian bags are relatively cheap, readily available and durable. The material also eases bulk packing and transportation of products with little or no attention paid to the quality of products stored. The role of packaging in the food industry which includes protection, containment, preservation and advertisement was not achieved with the use of hessian bags for the packaging of gari. Moreover the traditional use of hessian and polyethylene bags in the packaging of gari has no label declaration of nutritional data, storage conditions and shelf-life (expiry date) of products.

No visible spoilage was observed by the respondents in the use of polyethylene bags during the survey. However there was likelihood of variation in the nutritional attributes of

product depending on the duration of storage. Ninety percent (90%) of the respondents agreed that an advantage of transparent plastic film is that the products are visible and thus makes the checking of the content easier. It was however affirmed that the products may look attractive and normal from outside but its quality may be musty and completely bad when it is touched or tasted after storing for a long time or when stored in a humid environment. This is an indication that faulty packaging can conveniently undo all that a food processor has attempted to accomplish by the most meticulous method of manufacturing practice (Fedrica, 2001; Robertson, 1993). The polyethylene plastic film is favoured because of its suitability against a major constraint of the keeping quality of gari that is its hygroscopic nature.

Storage Duration

Ninety percent (90%) of the respondent stored gari for between 1-6 months, 8% stored for 6-12 months while 2% stored for above 12 months in hessian bags. The reasons for the variations in storage durations include small profit margin as gari seem to have a relatively uniform price all the year round, increase in storage losses, low capital investment, among others. Most customers also prefer the fresh gari which normally have a more acceptable aroma.

Plate 1: Gari packaged in improvised packaging materials

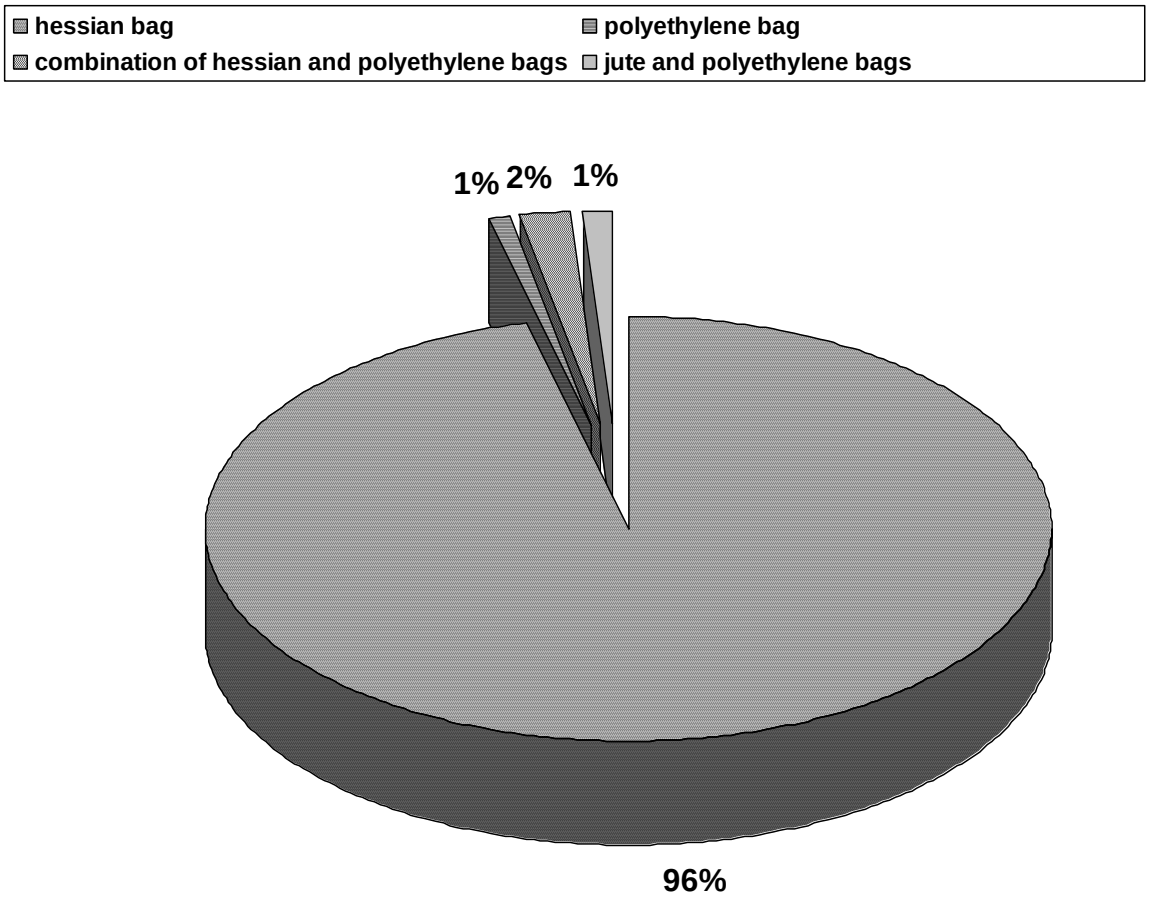

Figure 1: The Percentage use of Packaging Materials for Gari Packaging

Effects of Packaging Material on Stored Gari

The hessian and jute bags are not moisture proof or airtight and the stored gari which is hygroscopic in nature makes the use of these bags grossly inadequate. Gari packaged in hessian bags and stored in a humid atmosphere can absorb sufficient moisture making it vulnerable to the growth of fungi organism. The absorption of moisture by the product leads to microbial growth, change in color, odour, taste, caking thereby reducing the quality and market value of gari.

The percentage loss of gari during storage ranges between 3-10% for the packaging methods assessed (Table 1) which is a function of the type of storage materials, storage conditions, storage duration and the quality of the gari before storage. The losses were in terms of change in colour, odour and taste. The hessian, jute and polyethylene bags can easily be torn due to continuous handling and re-use leading to losses of products during storage and transportation. In line with these findings the problem of poor keeping quality of many dehydrated foods in the tropics was observed to be related to their moisture uptake during merchandising (Kumar, 2000). This is perhaps due to poor packaging materials and the levels of moisture at which they are prepared and exposed. Chuzel and Zakia (1991) predicted the shelf life of gari using the Heiss and Eichner equations. The shelf life was reported to be a function of the initial and equilibrium moisture contents,

vapour pressure at storage temperature, the surface area and permeability of the packaging materials. They concluded that less permeable materials like polyethylene bags will enhance the extension of gari shelf life based on the prediction using this equation.

Table 1: Summary of the assessment of gari packaging method of in Ogbomoso Nigeria

Assessment criteria	Percentage (%)
% of stored product	5-10
Duration of storage (month)	1-6
% loss of stored product	3-10
Types of losses	Change in colour, odour, taste and pasting qualities
Causes of losses	Moisture absorption, mould growth, insect, transport and torn bags
Retailing methods	Sold from open container using various sizes of measure, 50Kg bags

Method of Retailing Gari

One of the other popular methods of handling of gari is the sale from open containers, polyethylene sheets or mats spread on the ground (Plate 2). Ninety-five percent (95%) of the respondent retail gari from open containers, 4% from mats and 1% in 50kg bags usually wholesalers. This practice often by hawkers and retailers on the road sides or busy markets with dusty roads and unhygienic environments leads to obvious contamination by dusts, stones and other contaminants. The product is also exposed to the very humid environment especially in the wet season.

Plate 2: The Sale of Gari on Mat in Arada Market, Ogbomoso

CONCLUSIONS

It can therefore be concluded that the packaging materials and retailing methods used for gari are grossly inadequate. There is the necessity to evolve packaging materials to effectively provide complete protection of the dehydrated product against moisture, light, air, dust, micro flora organisms, foreign odour and animal pest. The packaging materials should provide strength and ability to maintain original properties of product through storage, handling and marketing. The chemical composition of packages must also be approved for use in contact with foods, the cost be compatible with the value content and the protection needed (Willhoft, 1990; Oyelade, 2005).

The use of plastic packaging films cannot be overemphasized. If the processing of cassava roots into gari is well carried out and the environmental conditions at which it will retain its physicochemical properties identified then it will be less prone to deterioration and storage losses. There is therefore the need for further studies into the appropriate storage conditions and packaging materials for gari to ensure its protection against contaminants and increased shelf life. This will as well make gari more attractive to consumers, prevent contamination, increase shelf life and make them suitable for acceptance at the export market especially with the federal government initiative on cassava production and processing for export.

REFERENCES

Bencini, M. C. (1991). Post – harvest and processing technologies of African staple food.

A Technical Compendium. FAO Agricultural Service Bulletin 89. Rome: FAO.

Chuzel, G. and Zakhia, N. (1991). Adsorption isotherms of gari for estimation of packaged Shelf-life. International Journal of Food Science and Technology, 26: 583–593.

FAO (1994). African Experience in the Improvement of Post-harvest Techniques. Food and Agricultural organization of the United Nations, Agricultural Engineering Service (AGSE) Support Systems Division Workshop, Held in Accra Ghana 4th to 8th July, Rome. www.fao.org/docrep/W1544E/W1544E07.HTM

Fedrica, L. B. (2001). Corn In: The Encyclopedia Americana, Grolier International 7: 800-801.

Hahn S.K. (1992). An overview of traditional processing and utilization of cassava in Africa. Proceedings of the IITA/ILCA/University of Ibadan Workshop on the Potential Utilization of Cassava as Livestock Feed in Africa

IITA (1990). Cassava in tropical Africa. A reference manual. International Institutes for Tropical Agriculture, Ibadan Nigeria.

Kemdirim, O. C; Chukwu, O. A. and Achinenwhu S. C. (1995). Effect of traditional processing of cassava on the cyanide content of gari and cassava flour. Plant Foods for Human Nutrition 48: 335–339.

Kumar, K. R. (2000). Moisture sorption and packaging characteristics of arabian dry cereal foods. Journal of Food Science and Technology Mysore 37(3): 330-333.

Kwatia, J. T. (1986). Cassava: Storage, Processing and Utilization. Paper presented at IITA – UNICEF Consultative workshop on the place of Cassava in the Household Food Security, Ibadan, Nigeria.

Opara, L. (2002). CIGR (2002) Root crops. In CIGR Handbook of Agricultural Engineering Vol. IV: Agro processing Engineering. Ed. F. W. Bakker-Arkema, The International Commission of Agricultural Engineering, Pg157-181. Published by American Society of Agricultural Engineering.

Oyelade, O. J.; Igbeka, J. C. and Aworh, O. C. (2001). Moisture Isotherm of cowpea flour at 30^{o}C and 40^{o}C. Journal of Applied Science 4(1): 1700-1711.

Oyelade, O. J. (2005). Moisture sorption phenomena and their effects on film packaging of Cassava, (*Manihot esculenta, crantz*), Yam (*Discorea rotundata, Poir*) and Maize (*Zea mays, Linn*) flour. Unpublished Ph.D. Thesis. Department of Agricultural Engineering, University of Ibadan, Nigeria.

Robertson, G. L. (1993). Food packaging: principles and practices. New York, Marcel Dekker Publishers.

Sailaja R. R. N and Chanda, M. (2001).Use of Melaic anhydride grafted polyethylene as compatibilizer for HDPE: - Tapioca starch blends: effects on mechanical properties. Journal of Applied Polymer Science, 80: 863-872.

Sanni, M.O. **(**1996). The stability of stored gari. International Journal of Food Microbiology. 29 (1): 119–123.

Willhoft, E. M. A. (1990). Packaging for preservation of snacks food. In: Snacks food (Ed) Booth, R.G: Van Nostrand Reinhold, New York.