Some problems with the food packaging practices in Ghana

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ABSTRACT

This paper examines the problems with the present methods and practices used for the packaging of both fresh and processed foods in the informal and formal sectors of the food industry in Ghana. The use of unsuitable packaging materials, inadequate and ineffective packaging, especially during transportation, cost of packaging, absence of appropriate packaging machinery, poor labelling, lack of standards and specifications and environmental issues have all been discussed. The effect of the increasing use of plastics as the main packaging material was examined. How these problems impact on the country's drive towards food security as well as promoting the export of food products have also been examined. Some recommendations have been made.

1. Introduction

Adequate packaging of either fresh or processed food is an essential and integral part of any comprehensive post-harvest management in any country. In Ghana, it is estimated that between 20% to 30% of fresh foods products including fruits, vegetables and tubers harvested by growers each year never reach the final consumer in the market because they are either lost or damaged during the various stages of the distribution chain (Johnson, 1987). Ensuring more careful handling, better temperature regulation, attention to phytosanitary requirements and the use of suitable preservation agents can reduce these losses. Such measures may be inadequate and even fruitless, however, if not combined with appropriate packaging. As unprocessed fresh foods and vegetables have a limited life span, suitable methods should therefore be adopted to ensure that the products' keeping qualities are maintained as much as possible throughout the transportation and distribution. The choice of an appropriate package, adapted to the product as well as to the distribution network and the market is therefore important to the products' success.

This paper, therefore, examines the problems with the present methods and practices used for the packaging of both fresh and processed foods in the informal and formal sectors of the food industry in Ghana. Emphasis has been placed on the present extensive use of plastics because of its increasing importance. The paper also examines the constraints confronting the players and makes a number of recommendations.

2. Some general principles on packaging

The five general and primary functions of a food package (Paine and Paine, 1983) are:

i. Keep the product clean and provide a barrier against dirt and other contamination.
ii. Provide protection to the food against physical damage, moisture, oxygen and light.
iii. Function smoothly, efficiently and economically on the packaging line during actual operation of putting food into the package.

iv. Have a degree of convenience built into its design which not only supply the ultimate consumer with say an easy-opening or reclosure, but also must provide convenience at the intermediate stage in handling through ware-house and transport during distribution. In particular, the size, shape and weight of the units must be considered.

v. Provide identification, information and must be appealing to customers. The retail packaged units must sell what they protect as well as protect what they sell.

Table 1 classifies packaging materials into two general groups as well as gives the types, mechanical and other physico-chemical properties of packaging materials. For plastics there are certain general characteristics that are of utmost importance. These are their stabilities to heat, strengths, perm abilities to water vapour and gases, migration of plastic packaging material ingredients into the food and tainting (Briston and Katan, 1974; Jenkins and Harrington, 1991).

Plastics soften when heated and set again on cooling. The reason for this behaviour is because plastics are made up of long-chain molecules that are held together by a series of relatively weak intermolecular forces. Some of these forces are van-der Waals and geometric forces normally characteristic of liquids.

Two main structural properties of importance are the tensile properties and the impact strength. The tensile strength of almost all the commonly used plastic packaging materials is time-temperature dependent. This means that the strength of the plastic is greatly influenced by comparatively small temperature changes in very short span of time. The extent of deformation increases with time. This means if plastic container is held at a relatively high temperature for a long time it is likely to be permanently damaged.

The temperature effect becomes more appreciable when one comes to consider the issue of using plastics to store oil. As is well known, oil has a relatively high specific heat capacity. Thus under a relatively high ambient temperature, oil stored in a plastic can absorb more heat than water. This in turn will heat up the plastic. This will result in the reduction of the strength of the plastic packaging material.

As temperature increases, almost all plastics packaging materials become more permeable to water vapour. However an increase in temperature leads to an increase in water activity of the packaged food, whilst the water activity of the surrounding air decreases. This means that the potential for water permeation will be reduced (de Leiris, 1986).

Other factors which affect the permeability of plastics (Briston and Katan, 1974):

i. Crystallinity: The more crystalline the plastic the less permeable.

ii. Density: The more dense the less permeable.

iii. Molecular Orientation: Reduction of permeability value can reach about 50% for oriented polymers.

iv. Additives and Plasticisers as well as monomers and polymers added to plastic materials do modify the properties. There is a general increase in permeability. For example, when rubber is added to PVC to obtain flexible PVC, the product obtained is more permeable. This is mainly because of the diluting effect of the rubber at the active sites in the PVC. Under high humidity, water molecules cause a plasticising effect of the polymer. This results in an increase in permeability.

Another factor of importance to plastics as packaging materials is migration. This is a term used in food packaging to mean the transfer of ingredients from the plastic packaging material into the food by a diffusion process. The resulting interactions of the components of the food with the packaging can cause a decrease in the impact resistance of the packaging material. Fatty components migrating into plastics like polyethylene or polypropylene usually increase the mobility of the plastic ingredients. In addition, migration

Table 1. Packaging classification, types of mechanical and physico-chemical properties

Classification of Packaging Materials	Type of Packaging Material	Physico-chemical Properties		
		Physical	Chemical	Mechanical
A. Flexible/ Soft Materials	Paper	Light, translucent to opaque, varied colours, low physical protection to food, convenient to handle, easily printable, attractive, fit closely around product.	Chemically reactive, contaminate food.	Not tough to withstand stress and rough handling, it has folding endurance.
	Plant origin	n.a	n.a	n.a
	Metal Foil	Light, variable colours, good barrier properties to moisture	Chemically reactive if wrong metal foil is selected.	Has high folding endurance, low resistance to impact damage, wear and tear easily.
	Cloth	Light, varied colours, low resistance to heat, low protection to food, transparent, translucent and opaque.	Chemically reactive, could contaminate food.	wear and tear easily under stress and strain.
B. Rigid/ Hard Material	Glass	Impermeable, Varied colours Sanitary and odourless, can be opaque or transparent high physical protection to food, fragile high densities, attractive good conductor of heat shatters on abrupt change in temperature.	Inert, barrier to micro organisms and atmospheric influence, do not contaminate food.	Unsqueezable strong and tough under load, wear and tear under high stress, easily broken if knocked, it's subject to thermal shock.
	Wood	Bad conductor of heat heavy, opaque, protection to package is offered Impermeable. It's subject to thermal shock	Chemically reactive.	Hard and tough, Resistant to impact damage.
	Metal	Good conductor of heat, Lighter in weight, moderately resistant to physical damage. Not subject to thermal shock.	Little or no reaction between food and can occur provided the correct type of can is selected.	Resistant to impact damage.
	Ceramic (including pottery)	Permeability is low for unglazed earthenware, impermeable for stoneware, high density, varied colours usually opaque, good conductor of heat. Attractive.	Does not usually contaminate food, however unglazed earthenware may react under some chemical attack.	Behaves like glass.
	Paper Board	Permeable to liquids, Variable colours, light, heavy suitable for printing. It's subject to thermal shock.	Chemically reactive.	Stiff resistant to impact damage.
	PVC hard	Impermeable, varied colours, can be transparent or opaque, low temperature resistance, have a poor barrier against oxygen and CO_2 which causes discolouration of e.g., tomato paste. Damages under high temperatures.	Chemically reactive.	Resistance to impact damage.

n.a = not available

may result in the ingress into the food of adventitious materials, such as dirt and other products of secondary interactions arising from the primary interactions (vom Bruck *et al.*, 1986). Table 2 gives a summary of the characteristics of the popularly used plastics in Ghana.

3. Packaging practices presently used in Ghana

There are diverse forms of packaging in Ghana. For example, at the traditional level most fresh/cooked foods are packaged in leaves (banana, plantain and corn husk), vegetable fibres, wood, papers, and ceramics. The type of food, form and level of freshness,

Table 2. Some characteristics of plastic films commonly used for food packaging in Ghana: permeabilities, resistance to solvents and sunlight

Plastic Film	Permeabilities			Resistance to					
	O_2 at 25°C	CO_2 at 25°C	Water Vapour at 37.8 °C	Chemicals				Solvents	Sunlight
	(in cm^3 mil/m^2. 24h. atm)	(in cm^3 mil/m^2. 24h. atm)	(in g.mil/m^2 .24 h at 90 % RH) difference	Weak acid	Strong acids	Weak alkalis	Strong alkalis		
Polyethylene: Low density	8500	45000	20	**U**	**A**	**U**	**U**	Swelling with aromatic and chlorinated hydrocarbons.	Surface becomes irregular except in formulations or black grades.
High density	9300	7000	5	U	A	U	U	-do-	-do-
Polypropylene	1500	2300	5	U	A	U	U	n.a	n.a
PVC soft	150	6000	5	U	A	U	U	Soluble in esters and ketones. Attacked by chlorinated hydrocarbons	Good when stabilised.
Polyethylene terphthalate (PET)	250	550	21	U	A	**U**	U	n.a	n.a
Polystyrene	5000	13000	145	U	A	U	U	n.a	Not suitable for outdoor use

Source: Paine and Paine (1983), Brennan (1994) and Johnson (1997) U = Unaffected A= Attacked
n.a = not available

processed/unprocessed nature, time between purchase and consumption, for local market or for export will determine the type(s) of packaging required.

Most traditional maize products are packaged in leaves, the common being *Thespesia populnea* (Malvaceae family), *Marantolclea* spp. (Marantaceae family) and the *Musa* spp. (Plantain family) and sheaths of *Zea mays* (maize) (Essuman, 1990).

Table 3 gives the commonly used staple foods and the packaging materials used at the primary, secondary and tertiary levels.

There are a number of problems connected with traditional food packaging in Ghana. Some are:

i. No rational basis exits for selecting different packaging materials for the various types and groups of food.
ii. Consideration for Package-Product-Environmental Interaction not fully appreciated.
iii. Available packaging materials do not have consistent quality and cost varies from season to season.
iv. Lack of specialised equipment and packaging systems in general. For example, the inadequate and unhygienic filling and sealing system for some so-called 'ice-water sellers.

Table 3. Some staple Ghanaian foods and the type of materials and systems used at three levels of packaging

Examples of food type	Primary packaging	Secondary packaging	Tertiary packaging
Dough, especially maize dough and kenkey	Plant leaves, paper wrap and polyethylene warp	Basket, cotton, jute and metal tray	Basket, cotton jute, metal tray
Fermented beverages (palm wine, *pito* and beer)	Pots, gourd bottles and glass bottles	Cartons, wood chest and plastics crates	Cartons, wood chest and plastics crates
Fried and/or roasted plantain, yam and cocoyam	Paper or plant wrap	n.a	n.a
Roasted groundnut	Plastic film, paper or plant wrap	Baskets	Baskets
Raw beef and fish	Plastic film, paper or plant wrap	Plastics	Aluminium/ enamel bowls
Oil preserves (sauce, *shito*, etc.) and cooking oil	Glass jars/bottles, ceramic pots, plastic pots low density polyethylene	Cartons, wood chests and plastics	Metal cans

Source: Obiri and Dzamboe (1992) n.a = not available

4. Packaging for the export market

Products for the export market, whether fresh or processed, requires additional consideration. Different countries differ in their packaging requirements with regard to factors, such as package dimensions, arrangement of the products within the package, number of units, packaging colour and labelling. The examples given below will illustrate this point.

For instance, upon receipt of a package of fresh goods, importers in the different EU countries will usually open the package and then repackage them for the retail market with the appropriate labelling. Under such circumstances, it is probably pointless, and certainly more costly, for exporters to use expensive primary and probably secondary packaging materials, which may not be appropriate for the intended market. This factor is important for determining the extent to which packages are filled, their strength, cost, and the shipping and other costs.

In addition to providing protection throughout the distribution process, packaging performs other important functions, which Ghanaian exporters of food products must bear in mind to maximum their marketing success.

There are a number of factors are affecting the packaging of food for export. Some are limited types and forms of flexible and rigid packaging materials at the primary, secondary and tertiary levels. Others are that over 90% of the basic raw materials used in packaging (for eg., paper, plastics, foil) are imported. Relatively high cost of packaging for food products compared to eg., electrical/electronic goods/machinery. Additional factors are lack of institutional framework for packaging design, development and production, minimum support given for Institutions working on packaging testing and development and limited standards and specification on food packaging in general.

5. Standardisation on packaging

In Ghana, waste paper or old newspaper serves as a means of protecting the package contents, either as the immediate wrapping for fresh foods. The resulting presentation is not attractive. At the cargo section at the KIA, it is usually observed that some packaged fresh fruits have their packs damaged before being put on the plane. Some packages are defaced also. It should be noted that as packaging sells the product, a pleasing or attractive outward appearance convinces a buyer about the quality of the goods or product inside the package. Two elements should be given attention in presentation of packaging for exports - the package itself and the printing on it. It is recommended that as much as possible packages be white surfaced. White boxes are more attractive, and printing shows clearly. Though they may be considered more expensive than other papers, they must be seen as being worthwhile in the long run. Furthermore, a white surface is more easily scratched and marked and so requires more precautionary measures to keep it looking neat, both at the packing station and in subsequent handling.

In any case, white finishes, lively colours and elaborate designs can never be a substitute for packaging that is strong enough to protect and preserve the contents.

6. Marking and labelling

Identification and marking are the functional aspects of package presentation. Most packaging on the local market as well as those for export are not marked adequately. Importers are particularly concerned with the issue of marking, as precise, accurate and instantly understood marking can help prevent loss of time, errors, claims and litigation. Strange to relate, some exporters of tubers, cocoyam, and yams etc., were packaging their products in "Milo" cartoons, sardine boxes without the appropriate marking and labelling.

Compliance with Ghana Standards Board/International standards, regulations and requirements on marking is essential. The marking shall indicate clearly on the package the supplier's name and/or brand and the name of the country of origin. As well as being obligatory, this information represents a useful form of advertising for the food supplier.

Printed characters and symbols, the only markings that can be easily interpreted in any country, are preferred to written markings. The various items of commercial information should always be printed on both ends of the package, since at least one end can remain hidden.

7. The recommended standards

A label attached to the package or a separate document that can be readily consulted by inspection services should accompany products. It should include the following information:

i. Identification;
ii. Packer and/or shipper (name and address, or an official identifying symbol);
iii. Nature of the product;
iv. Origin of the product;
v. Country of origin, and possibly the region of production or a national, regional or local name;
vi. Commercial characteristics;
vii. Category;
viii. Where required, size (stem, length code) or maximum stem length;
ix. Official or inspection marks: -This is not obligatory.

The products should be packed in a manner that ensures their protection. Packaging materials, and especially the paper used inside the pack, should be new, clean and of a material that cannot cause any alteration, either external or internal, of the product. Newspaper should not be used in direct contact with product.

6. Conclusions and recommendations

There are limited choices of raw materials from producers and users in the packaging industry in Ghana. Virtually all the basic raw materials for paper and plastics are imported. Packaging is non-existent at some primary and secondary levels at the non-formal traditional levels.

The skills and equipment needed or available for developing the packaging industry in Ghana are lacking even among research institutes. It is recommended that more research and development studies are conducted with specific emphasis on product-package-environment interactions. Moreover, public awareness of the proper use of different types of packaging materials for different types of foods must be stepped up.

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