'Sterilite', a new wrapping material to improve the shelf-life of *Ga kenkey*

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SUMMARY

The effects of traditional methods and materials used in wrapping Ga kenkey on the shelf-life of the product have been studied. It has been shown that deficiency in the use of the traditional packaging material, i.e. corn cobsheath, is mainly responsible for the short shelf life of the product. A new type of polyfilm 'Sterilite' has been investigated and it has been shown that it can be used as a post processing wrapper. When used as such, the shelf-life of the product can be prolonged to a period of 9 months or more.

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RÉSUMÉ

ATA, J. K. B. A. & DEI-TUTU, J.: *Un nouvel emballage, la 'stérilite', capable de prolonger la durée de la conservation familiale du* Ga kenkey.

Les auteurs ont étudié les effets des méthodes et des matériaux traditionnels pour l'emballage du Ga kenkey, sur sa durée de conservation familiale. Il a été démontré que l'insuffisance du matérial d'emballage traditionnel (par exemple les enveloppes des épis de maïs) était le principal responsable de la brièveté du temps de conservation du produit. Un nouveau type de film de plastique, la 'stérilite' a été essayé et il a été prouvé qu'on peut l'utiliser comme emballage, juste après la préparation du Ga kenkey. Utilisé de cette manière, il prolonge la conservation du produit jusqu'à 9 mois ou plus.

Introduction

Kenkey is a product of white maize, *Zea Mays* L. It ranks prominently among the foods of Ghana and its importance, especially in the coastal belt of the country, is comparable to that of bread in the wheat producing countries or tortilla in Mexico, the original home of maize. The food is produced mainly from whole meal maize though other varieties are manufactured from degermed maize. In Ghana, two main types of kenkey are distinguished. These are *Ga kenkey* and *Fanti kenkey*, the names depicting tribal grouping from which kenkey production originated. The difference between them occurs mainly in the packaging material used. While Ga kenkey is salted and wrapped in the cobsheath of maize, the Fanti type is generally unsalted and wrapped in banana leaves.

Kenkey is a ready to serve 'convenience' food. It is eaten at anytime of the day as a main meal in the homes, restaurants or in snack bars. It is usually served with fish and sauce or with soups and sauces containing meat.

The chemical composition of four types of kenkey has been provided by Eyeson & Ankrah (1975) as is represented in Table 1. All types have high moisture and carbohydrate contents.

The production of kenkey has not yet been mechanized and it has remained a small back-yard operation handled by women.

As a traditional operation, it suffers many drawbacks, the greatest of which is packaging that accounts for the perishable nature of the product. Observation has shown that Ga kenkey at ambient temperatures (27–30°C) cannot keep for more than 3 days, and under refrigeration (4°C) for more than 5 days, without moulding setting in. Fanti kenkey, on the other hand, has been observed to keep slightly longer reaching 8–12 days at ambient temperature and longer still

in cold storage. The difference between the storage ability of the two types of kenkey was traced to the volume of wrapping on the product. While the banana leaf completely wraps the Fanti kenkey, forming 6–7 layers of wrapping, results of measurements on Ga kenkey showed that 8–12 per cent of the surface area of the processed food was exposed.

This drawback greatly enhanced mould development, other physical contamination and loss of moisture in Ga kenkey which is not the case with Fanti kenkey. It was, therefore, hypothesized that with improved wrapping of the Ga kenkey in particular, the shelf-life could be extended.

It was also thought that the perishable nature of the product, made its distribution through supermarkets and departmental stores expensive and a risky proposition. This apart from limiting the channels and points of sale of the product, hampered its mass production and other factors associated with it.

The objective of the present studies was to examine the suitability of 'Sterilite' and aluminium foil wrapping materials in Ga kenkey production.

Materials and methods

Among various flexible packaging materials, the one selected was 'Sterilite'. The advantages of this polyfilm and its usefulness in the processing of foods with desirable characteristics similar to kenkey have been discussed by Mapp & Neiboer (1972).

In one batch of trials, freshly moulded and uncooked kenkey balls were wrapped separately in 'Sterilite' and aluminium foil and cooked following the traditional method previously described by Dei-Tutu (1965) and Ofosu (1971). Some kenkey wrapped in the traditional sheath was also boiled and used as control.

In another batch of trials, kenkey was cooked normally, wrapped in traditional corn sheath. Immediately after the cooking, whilst hot and without the corn sheath removed, some were placed into 'Sterilite' formed into pouches and heat sealed. Some were wrapped in aluminium foil and the control was not wrapped in any other additional material. All the wrapped samples were again flushed with steam and kept in the laboratory storage room at 27–30°C for observation. In all, 10 batches containing five balls of kenkey in each batch were tested with 'Sterilite' material. The trials using aluminium foil proved unsuccessful and were discarded.

In the course of the experiment, kenkey samples were weighed and measurements of surface area were taken so as to be able to relate the size of kenkey to the size of packaging material in future cost calculations.

The stored kenkey samples were examined for the following parameters:

(1) surface hardness
(2) visible signs of mould growth
(3) flavour
(4) taste

For flavour and taste, an untrained panel of five laboratory technicians were employed to taste the stored 'Sterilite' packed samples and to compare them with freshly cooked kenkey bought from the market. Before the stored samples were tasted, they were boiled for about 5 min in water. This was to simulate the manner in which products would be used in the home, i.e. warming before consumption.

Results and discussions

Even though the other types of kenkey were not specifically examined in this experiment, their analytical data have been provided (Table 1). The data show the similarity in some of the forms of kenkey in Ghana. The high moisture and carbohydrate contents are significant in any spoilage process, in particular by moulds, and more so when 8–12 per cent of the material is exposed to the atmosphere where these micro-organisms proliferate. *Penicillium, Aspergillus* and *Rhizopus* species are the ones most commonly found on mouldy kenkey. This defect in wrapping also encourages dehydration if the kenkey is kept even for a day due to high ambient temperatures of 27–30°C.

The results in Table 2 indicate the size of manufactured kenkey in terms of weight in the middle of 1975. The calculated percentage exposed surface due to incomplete wrapping ranged from 8–12 per cent. Incomplete wrapping is a characteristic feature of manufactured Ga kenkey but there is no confirmation that it is done deliberately. It is probably due to the result of

TABLE 1
Proximate Composition of Kenkey

Kenkey type	*Moisture*	*Protein*	*Fat*	*Carbohydrate*	*Fibre*	*Ash*
Ga	68.8	3.1	0.4	27.7	1.3	0.6
Fanti	66.2	4.3	0.5	28.3	0.5	0.7
Ewe	69.5	6.7	0.3	22.7	0.7	0.9
Ashanti	71.0	1.8	0.2	26.8	0.3	0.2

TABLE 2
Measurements on Ga Kenkey (Samples of July 1975)

Sample numbers	*Weight (g)*	*Exposed surface area (per cent)*
1	192.8	9
2	189.9	11
3	184.3	12
4	205.5	9
5	191.4	10
6	205.5	9
7	198.4	8
8	195.6	10
9	201.3	11
10	191.4	9
Mean	195.6	9.8

expansion in the kenkey volume due to gelatinization during the cooking process. On the other hand, it appears to be technologically useful in the cooking process, hence it has not been necessary to provide the type of wrapping that will eliminate the surface exposure. It is also thought that whilst with the banana leaf, as is used in wrapping of Fanti kenkey, several layers of wrapping can be achieved, the nature of the corn cobsheath does not make this practice technologically feasible.

It was observed that given the same cooking time as the traditional wrapped type, the kenkey samples in aluminium foil were cooked but the outer surfaces of the kenkey were hard. Similarly,, the samples cooked with 'Sterilite' as wrapper exhibited the same surfaces hardness. In addition, samples wrapped in 'Sterilite' lost their characteristic shape. This was because the 'Sterilite' material does not have the rigidity to maintain the shape of the kenkey ball during the process of cooking. From the observations made above, it is suggested that contact of the kenkey with water or wet steam was necessary during the cooking process in order to avoid hardening of the surface. This seems to explain the rationale behind single layer wrapping in the case of Ga kenkey as opposed to multiple wrapping in Fanti kenkey.

The examination of samples of cooked kenkey wrapped in aluminium foil, showed that aluminium foil could not be used because wherever it came into contact with the kenkey, a sore developed, leading to mould attack on the kenkey. This sore is formed probably as a result of the effect of the acid in the kenkey on the material. The kenkey wrapped in alumium foil, therefore, suffered the same fate, namely mould attack, as the unwrapped or control.

On storage, the samples in traditional packaging material grew mouldy after 72 h at 27–30°C, with average relative humidity of 86 per cent. The samples stored in 'Sterilite' as a post-cooking wrapper, remained mould free during the storage period of 9 months. From the success of this trial, over 50 balls of kenkey were similarly treated on semi-commercial basis and stored for similar lengths of time.

All samples were mould free. When the samples were opened after the storage period and subjected to taste tests, they were scored very high in retention of flavour, taste and texture.

One of the properties of the 'Sterilite' material is its non-permeability to gases. Consequently, when the kenkey is packed under sufficiently sterile conditions, it is protected from further contamination from the outside environment. Similarly, the flavour and moisture levels of the kenkey are retained in the pouch.

Conclusion

The studies have shown that the present short shelf-life of Ga kenkey is due to incomplete protection of the product from moulds. The tradi-

tional system of wrapping and the material used cannot guarantee this needed protection. The traditional corn cobsheath, however, has a functional property which does not allow its complete elimination from the traditional processing technique. The results, however, showed that 'Sterilite' material could be used as a post-processing wrapper to prolong the shelf-life of the product for at least 9 months instead of the present maximum 60–72 h. This development, if pursued, may improve considerably the marketing trends as well as processing schedules, now drastically affected by seasonal variations.

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REFERENCES

Dei-Tutu, J. (1965) *Some mechanical aspects of kenkey preparation*. Accra: Food Research Institute (Mimeo).

Eyeson, K. K. & Ankrah, E. K. (1975) *Composition of foods commonly used in Ghana*. Accra: Food Research Institute (CSIR) (Mimeo).

Mapp, A. C. & Neiboer, S. F. T. (1972) Heat processed foods in flexibles. *Packag. Rev.* **9**(2), 50–52.

Ofosu, A. (1971) Changes in the levels of niacin and lysine during the traditional preparation of *kenkey* from maize grain. *Ghana Jnl agric. Sci.* **4**, 153–158.