

Studies on the development of *Tatale* mix, a plantain product

J. DEI-TUTU

Food Research Institute, P.O. Box M.20, Accra, Ghana



SUMMARY

Tatale mix, a dehydrated convenience food based on ripe plantain has been developed. The level of ripeness of plantain was found to affect the texture of *Tatale* produced from the mix. The best stage of ripeness of plantain for *Tatale* mix was found to be a stage between firm ripeness and very soft ripeness. The mix produced good quality *Tatale* after 18 months storage.

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Introduction

Tatale is the Ghanaian name for a kind of pancake made from soft ripe fruit of the plantain plant (*Musa paradisiaca*) and fermented whole-meal dough of maize (*Zea mays L.*). It is seasoned with condiments like ginger, pepper, onion and salt. A paste prepared from these ingredients is fried in palm oil into *Tatale* which may be served alone or with beans either as a main meal, snack or dessert.

Kaklo, another product made from the same ingredients as *Tatale* is prepared by making the paste thicker so that it can be formed into balls which are deep fried in cooking oil. It is served in much the same way as *Tatale*.

Though these products are delicious and highly acceptable, their preparation is cumbersome involving peeling, pounding, grinding, mixing, fermentation and frying (Whitby, 1968; Dede, 1969; Dovlo, 1970), and consequently people prefer buying to making them at home. By the introduction of dehydrated mix like the one described in this paper, it is hoped that most of the laborious aspects of *Tatale* making will be removed. Further, a mix of this nature, besides being a convenience

RÉSUMÉ

DEI-TUTU, J.: *Etudes sur la mise au point du Tatale concentré à base de bananes-légumes (plantain)*. L'auteur a mis au point le *Tatale* concentré, un aliment agréable, déshydraté à base de bananes-légumes mûres. Il a été observé que le degré de maturité des bananes-légumes influençait la consistance du *Tatale* produit avec le concentré. Il a été démontré que le meilleur stade de maturation des bananes-légumes pour la fabrication du *Tatale* concentré est intermédiaire entre la ferme maturité et la maturité très molle. Le concentré a donné du *Tatale* de bonne qualité après 18 mois de conservation.

food, may serve as a means of preserving ripe plantain whose storage has so far been a problem in Ghana.

Materials and methods

In this study, all the experimental materials, *viz.*, plantain (Apentu variety), maize, palm oil and spices were purchased in the Makola Market in Accra. Maize dough was prepared in the traditional way by steeping the maize in water for 2 days, draining the steeping water and washing the grain thoroughly. The wet maize was ground in a corn mill, and sufficient water was added to the meal to form a dough having a moisture content of 55%.

The dough was held at room temperature (28°C) for 3 days for fermentation. The fermented dough was broken up into small pieces, spread on a stainless steel tray and dehydrated in an Apex Cabinet hot air dryer (Type B35E) for 4 h with the temperature setting at 70°C. The dry dough was milled in a Christy and Norris laboratory mill (mesh size No. 7) and stored in a wide neck glass jar with a ground glass stopper for further use. Plantain was bought at the mature green stage

and allowed to ripen. The changes in starch and sugar levels during ripening were determined by the methods of Lintner for starch and the Lane and Eynon's volumetric method for sugar (Pearson, 1970).

Preparation of the wet mix

Uniformly ripened plantain in the firm ripe state were thoroughly washed in running tap water and divided into three groups.

Group 1 described as 'firm ripe' was processed immediately. Twenty five fingers of plantain in this stage of maturity were peeled and cut into pieces of about 2.5 cm thickness. The pieces were immediately steeped in a 0.3% solution of sodium metabisulphite for 3 min, drained and blended into puree in a Kenwood Chef food mixer. To 6 kg of puree was added 300 g (5%) of powdered maize dough. The mixture was blended in a dough mixer and was spread on stainless steel trays to a thickness of about 0.5 cm.

Group 2 described as 'very soft ripe' consisted of firm ripe plantain that was held further for for 5 days at room temperature until it became very soft ripe and the skin turned black, very similar to the stage at which it is used for making Tatala or Kaklo in the traditional way.

The third group of firm ripe plantain was divided into five subgroups which were held at room temperature for 12 h, 24 h, 36 h, 48 h and 60 h respectively. Those held for 48 h were found to possess desirable characteristics for processing, and were designated 'moderately soft ripe'. For all subsequent work this designation was used for firm ripe plantain that had been held for further period of 48 h. Groups 2 and 3, moderately soft ripe and very soft ripe were treated like Group 1 for dehydration.

Dehydration

The samples were inserted into the Apex Cabinet hot air dryer with the temperature setting at 70°C and dehydrated for 12 h to a moisture content of about 6%.

Midway during drying, the semi-dry paste was cut into strips and peeled off using a stainless steel spatula in order that it might not stick hard to the tray when dry. The dry product which looked like corn flakes, was cooled overnight in a desiccator, pulverized in the laboratory mill and packed into polyethylene pouches in 200 g packs. Two of such

packs were stored in a desiccator and 10 were held on the laboratory shelf for 18 months under observation. In all, four batches each of mix were produced using plantain at firm, moderately soft and very soft levels of ripeness.

Reconstitution, frying and evaluation of end products

Immediately after grinding, the mix was reconstituted and fried in order to establish the amount of water needed for reconstitution and the correct procedure of making Tatala out of the product. To 100 g samples of the mix were added 100 g, 150 g and 200 g of water respectively to form a paste. The pastes were beaten for 20 min, each in a food mixer. Spices were added and the mixtures were fried and examined. Reconstitution, frying and examination were repeated at 6 months intervals during the 18-month storage period.

Acceptability tests

Acceptability tests were conducted using Tatala prepared from firm ripe, moderately soft ripe mixes and Tatala prepared in the traditional way. A panel of 10 drawn from the Food Research Institute staff was presented with three coded samples of Tatala, two of which were produced from the firm ripe mix and the third by the traditional process. In another test, Tatala prepared from moderately soft ripe mix was compared with the one made by the traditional process.

Moisture content

Moisture content of samples was determined on 5 g well-mixed sample in a ventilated drying oven at 105°C ± 1°C to constant weight.

Results and discussion

Tables 1-4 summarize the results of the various

TABLE 1
Changes in Starch and Sugar Contents of Plantain during Ripening (wet weight basis)

	<i>Mature green</i>	<i>Firm ripe</i>	<i>Soft ripe</i>	<i>Very soft ripe</i>
Starch content %	31.2	16.1	8.5	3.3
Sugar content %	2.3	27.5	45	31.0*

*Onset of fermentation.

experiments. An observed property of the mix during the 18-month storage period was its hygroscopicity and tendency to fade in colour. These properties are, however, normal for air-stored dehydrated foods. Caurie (1971a) noted that a dehydrated material will absorb moisture from the environment if the environmental humidity is higher than the humidity that corresponds to the moisture content of the material. Lea (1958) listed oxidation of pigments, flavour constituents, vitamins and fats as some of the changes which take place during the storage of dehydrated foods. It was significant, therefore, that samples of the mix held in the desiccator did not show the colour change observed in those samples held on the laboratory shelf during the storage period.

For reconstitution, it was observed that two parts of the mix to three parts of water resulted in a loose paste that was easy to fry into *Tatale*. On the other hand this consistency was not suitable for *Kaklo* as the paste was too loose to be formed into balls (Table 3). Making the paste thicker resulted

in an undesirably hard product after frying. It was also noted that if the reconstituted paste was allowed to stand for a while before frying, the particles absorbed water and swelled making the paste thicker but not sufficiently thick enough for *Kaklo* consistency. As pointed out later, beating the paste for 20 min was necessary for a desirable light texture to be attained in the end product. During this period the necessary swelling also takes place.

It was also observed that the paste prepared from very soft ripe plantain failed to dehydrate properly. It had a glazed appearance and was plastic in texture making pulverization impossible. Because it could not be pulverized, reconstitution was difficult and time consuming. Nevertheless, once reconstituted, it gave good quality *Tatale*. On the other hand, the product derived from firm ripe plantain was crisp and easy to pulverize, thereby, making reconstitution almost instantaneous. *Tatale* produced from the firm ripe plantain, however, had the tendency to develop a hard texture upon cooling. This textural deterioration

TABLE 2
Proximate Composition of Tatale Mix, Plantain and Corn Dough

Sample	Protein %	Fat %	Moisture %	Ash %	Iron	Calcium (mg/100 g)	Phosphorus
<i>Tatale</i> mix	5.9	0.7	6.3	2.6	3.5	3.4	86
Ripe plantain*	1.2	0.3	65.4	1.0	1.3	8	38
Corn meal*	9.3	3.8	12.2	1.3	4.2	17	218
Corn dough	11.7	4.2	4.5	1.3	4.7	23	264

*Food Composition Table for use in Africa. FOA/US Department of Health, Education and Welfare Public Health Service (1968).

TABLE 3
Reconstitution of Tatale Mix; Effect of amount of Added Water on the Nature of Paste and End product

Weight of mix (g)	Weight of water (g)	Ratio of mix to water	Remarks
100	100	1:1	Paste looked normal but <i>Tatale</i> was too hard
100	150	2:3	Paste was loose but fried well
100	200	1:2	Paste was very loose; very difficult to fry

was less pronounced the more advanced the stage of ripening. It became necessary, therefore, to determine the stage of ripening at which it would be possible to pulverize the dried product and, at the same time, prevent the undesirable textural characteristic. The trials have shown that holding the firm ripe plantain for a period of 48 h was necessary to achieve the above results. Holding the firm ripe plantain beyond 48 h made grinding of the dried paste difficult while holding it less than 48 h resulted in *Tatale* which developed a hard texture upon cooling.

Table 2 shows that during ripening of plantain, the starch content decreased while the sugar content increased. It is of interest to note that the hard texture developed in *Tatale* on cooling is never completely eliminated and is observed, though to a lesser extent, even in *Tatale* or *Kaklo* prepared in the traditional way. The textural changes could be due to the rheological properties of starch, hence, the less the starch concentration the less pronounced is the hard texture which developed when the *Tatale* cooled down.

Heavy texture could also be, to some extent, due to the fineness of the particles of the mix as a result of grinding. It should be noted that in the traditional process the plantain is only pounded in a mortar with a pestle while the corn is milled only once. It was observed, therefore, that beating the paste in a food mixer was necessary for producing a good textured product. Beating the paste in a Kenwood food mixer for 20 min gave a very good result.

The difficulty in dehydrating paste made from very soft ripe plantain may be due to its higher

sugar content (Table 2). It is known that foods high in sugar content are rather difficult to dehydrate as sugar is a hydrophilic substance. Caurie (1971b) noted that the absorption of moisture by hydrophilic substances involves absorptive forces of great magnitude and that water which controls the stability of foods may exist as monolayer, multilayer and free water. These states, he noted, do affect the course of dehydration.

Conclusions

Tatale mix developed from ripe plantain and corn dough was successfully stored for 18 months. The main problem of *Tatale* produced from this mix was that of texture.

It was observed that the degree of ripeness of the plantain was critical for the production of a dry paste which could be pulverized into a mix that would produce *Tatale* with the desired texture. Another factor that also affected texture was particle size of the mix. This was controlled by aeration; beating the reconstituted mix sufficiently to incorporate air.

Taste panel results showed that provided the plantain was at the correct stage of ripeness there was not much to choose between *Tatale* made from the mix and that of the traditional process. It was further found that the amount of water added to the mix for reconstitution was important. If sufficient water was not added to the mix during reconstitution *Tatale* produced from the paste was too hard. Two parts of mix to three parts of water on weight basis was about the correct proportion for reconstitution. The mix developed

TABLE 4
Results of Organoleptic Evaluation of Tatale by 10 Judges

Attribute	Panel's opinion on samples							
	Like A	Like control	Like B	Like control	Like C	Like control	Like D	Like control
Appearance	8	9	10	8	8	9	9	9
Texture	4	8	3	8	8	8	8	9
Taste	6	8	8	8	8	8	8	8

Samples A and B were the same and were produced from *Tatale* mix made from firm ripe plantain.

Samples C and D were the same and made from moderately soft ripe plantain. Controls were made by the traditional process.

in this work is both a convenience food as well as a preservation technique for ripe plantain.

REFERENCES

- Caurie, M.** (1971a) *The storage environment and the stability of dehydrated foods*. Accra: Food Research Institute. (Mimeo.)
- Caurie, M.** (1971b) A practical approach to water sorption isotherms and the basis for the determination of optimum moisture levels of dehydrated foods. *J. Fd. Technol.* **6**, 85-93.
- Dede, A.** (1969) *Ghanaian favourite dishes*. Accra: Anowou Education Publications.
- Dovlo, F. E.** (1970) *Maize in the Ghanaian diet*. Accra: Food Research Institute. (Mimeo.)
- Lea, C. H.** (1958) *Chemical changes in the preparation and storage of dehydrated foods. Fundamental aspects of the dehydration of foodstuff*. London: Society of Chemical Industry.
- Pearson, D.** (1970) *The chemical analysis of foods*, 6th ed. London: J. & A. Churchill.
- Whitby, P.** (1968) *Foods of Ghana (Food Res. Inst. Bull No. 1)*. Accra: Food Research Institute.