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Quality of Chips Produced from Rehydrated Dehydrated Plantain and Banana

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Abstract: This experiment reports the effect of dehydration and rehydration of the physicochemical properties of chips produced from two commercially grown *Musa* species (plantain and banana) .The fat, ash, crude fibre and protein content in both samples were found to be low and their carbohydrate content were high. The processing of the fresh samples led to observable reduction in proximate composition of crude protein (15.41-7.21% and 13.20- 6.30%), crude fibre (3.00-1.36 % and 2.60- 1.58%), ash content (13.40- 2.42% and 8.80-2.91%) for banana and plantain respectively. However, an appreciable increase was found for carbohydrate (61.74- 82.29% and 74.99- 86.40%) and fat content 9 6.40-6.81% and 2.59- 2.82%) for banana and plantain respectively. The rates of dehydration and rehydration of the samples were found to decrease with increasing dehydration and rehydration time. The sensory evaluation of both plantain and banana chips revealed that dehydration significantly affected the quality of chips.

Key words: Rehydration, dehydration, chips

Introduction

The word ''Banana'' is a general term embracing a number of species or hybrids in the genus Musa of the family *Musaceae*. Some species such as *M. basjoor sieb* and *zucc.* Of Japan and *M. ornate roxb,* native from Pakistan to Burma are grown only as ornamental plants or for fibres (Maor, 1958). In some places, the distinction between plantain and banana is not that clear and the terms may be used interchangeably. In India for example, there is no distinction between plantain and banana (Morton, 1987)

In West Africa, plantains are consumed at five different stages of ripeness (Asiedu, 1980). Commercial production and marketing of fried green plantain and banana chips are commonly found in retail groceries alongside potato chips and other snack foods (Kay, 1987). Plantain chips are prepared by frying round slices of pulp in refined palm oil between 160 and 170^{o}C for two to three minutes (Onyejugbu and Olorunda, 1995). These generally absorb less frying oil than chips from cooking banana and dessert banana.

Materials and Methods

Treatment and processing: The ripe (mature) plantain and banana were obtained from a local farmer in Are-Ekiti, Nigeria and were pealed using a kitchen knife. The pulp was measured on a weighing balance; the average weights of the pulp (plantain and banana) were recorded. The plantain and banana pulp were sliced into a uniform thickness of <2mm by a manual slicer. Crisps were prepared immediately by dipping the slices for 2 minutes in a frying pan using vegetable oil at about 170^{o}C. One lot of each variety (plantain and banana) was processed into dehydrated slices by blanching in boiling water for four minutes.

The blanched slices were sulphited in an aqueous solution of Sodium metabisulphite (1g/Litre) for 10 to 20 minutes. The drained slices were dehydrated in a Gallenhamp oven at 80^{o}C until the moisture content of the slices fell to <10%. The rate of drying was estimated by recording the amount of water lost during a specific time interval. The drying ratio and the yield of the dry product were recorded. The dehydrated slices were stored into high-density polyethylene bags until used.

Rehydration of dehydrated chips: The rehydration of dehydrated slices was carried out by soaking the dehydrated slices in water at room temperature and also in boiling water. The amount of water absorbed by the slices was recorded at intervals of three, five, seven and ten minutes. The rehydration rate, ratio and time were estimated .The rehydrated slices were fried under the standard conditions. Their qualities were compared with that of the crisps made from dehydrated slices and fresh slices.

Physical properties: The physical parameters of the plantain and banana such as: the weight, pulp colour, and firmness were assessed, the weight was determined using a weighing balance, the pulp colour observed for mature but unripened banana and plantain was white and off-white respectively; the firmness of both was tested by thumb feeling.

Functional properties: The bulk density was determined according to Pearson (1976). The flakes (dehydrated form) of the sample (plantain and banana) were made into powder. Twenty grams was weighed into a graduated cylinder .The cylinder was then tapped for ten times and the volume was read on the graduated cylinder.

Table 1: Proximate Physico-chemical composition of Plantain and Banana

	Banana		Plantain	
	Fresh	Dehydrated	Fresh	Dehydrated
Bulk Density	-	0.63±0.00	-	0.59±0.00
WAC%	-	172±0.10	-	189±0.10
Dry Matter%	25.00±0.00	94.32±0.60	32.59±0.00	94.00±0.50
Crude Protein%	5.14±0.37	2.40±0.17	4.40±0.17	2.10±0.17
Fat Content%	6.40±0.00	6.81±0.00	2.59±0.00	2.82±0.00
Crude fibre%	3.00±0.00	1.26±0.10	2.59±0.00	1.58±0.00
Ash %	13.40±0.00	2.42±0.00	8.80±0.00	2.91±0.00
Carbohydrate%	72.06±1.10	87.11±1.50	81.62±0.50	90.59±0.20

Values are means of triplicate determination ±standard deviation and calculated on dry matter basis.

Table 2: Statistical analysis of the organoleptic Data of Plantain and Banana

Variety	Aroma	colour	Taste	Texture	Overall Acceptability
Plantain					
Fresh crisps	2.07^{a}	2.07^{a}	1.96^{a}	2.01^{a}	2.09^{a}
Rehydrated Crisps	1.72^{b}	1.44^{b}	1.72^{b}	1.73^{b}	1.75^{b}
Banana					
Fresh crisps	2.04^{a}	2.02^{a}	2.02^{a}	2.02^{a}	2.02^{a}
Rehydrated Crisps	1.84^{b}	1.83^{b}	1.83^{b}	1.91^{b}	1.90^{b}

Means with different superscript are significantly different ($p<0.05$)

Water Absorption Capacity and Proximate analysis: This was determined using the Quinn and Paton's (1976) method. The proximate analysis of the sample was then carried out.

Results

The moisture content of both fresh samples was high (about 75% and 67% in banana and plantain respectively) and low in the dehydrated samples for both (below 10%).The dehydrated sample has a high amount of dry matter of about 94%. Banana gave a high bulk density (0.625) compared to plantain (0.594). The water absorption capacity for both plantain and banana is high (172% and 187%for banana and plantain respectively). Table 1 shows that plantain and banana are low in crude protein, fat content crude fibre and ash. However they have a high amount of carbohydrate (below 81% for the dehydrated samples).

The rate curve (Fig. 1) determined under controlled conditions showed that there was similarity in drying rates of slices for both varieties. The drying ratio (Initial weight to final weight) in both plantain (1.21) and banana (1.24) are similar.

The rehydration rate of dehydrated plantain and banana chips in water prior to frying at ambient temperature (Fig. 1) appeared higher in the latter than in the former. Table 2 shows the results of the overall acceptability property of plantain and banana chips; chips made from fresh plantains and bananas were significantly ($p<0.05$) better than test samples.

Discussion

From the study, banana gave a higher bulk density compared to plantain. The higher the bulk density the lower the package volume or void fraction. The high water absorption capacity observed in both plantain and banana chips may be explained on the basis of their high hydrophilic properties, the presence of polysaccharides, and pregelatinization due to dehydration (Padmashree *et al*., 1987, Agunbiade, 1992). High water absorption capacity of products like plantain and banana, help improve yield and handling characteristics (Del Rosario and Flories, 1981).

The low moisture content observed in the dehydrated products (less than 10%) may be due to dehydration by oven drying. Dehydration is a good measure to extend the shelf life/stability and extensive distribution of processing product compared to the highly perishable property of the products in their raw state due to high water content. The high dry matter (about 90%) observed in the dehydrated sample is not expected due to loss of moisture content.

It was observed that protein content of fresh samples were higher than the dehydrated samples. Similar result

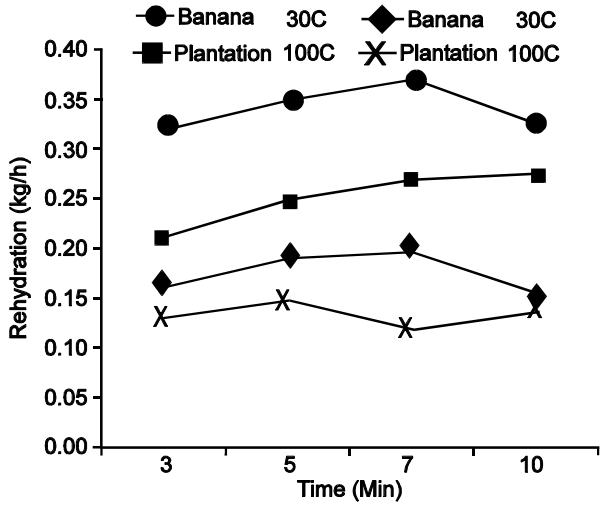

Fig. 1: Rehydration rate at ambient (30°C) and boiling (100°C) temperature

has been reported by Morton (1987); this may be due to inorganic nitrogen which might have been given off during dehydration, herby affecting the protein content of the dehydrated samples. The fat content of the dehydrated sample was higher than that of the fresh sample. This may be due to the increase in the analyzes resulting from the dehydration process. The high carbohydrate content reported in this work corroborated the report of Ketiku (1973) for plantain and Lii *et al*. (1982) for banana. This may be as a result of an increase due to loss of moisture resulting from dehydration.

Both banana and plantain have low crude fibre, which is the bulk of roughages in foods, and low ash content. The observed higher ash content in the fresh sample may be due to loss of minerals by volatisation. Fig. 1 indicates that it could take about 12hours at 80°C in an oven cabinet tray drier before the moisture content of plantain and banana could be brought below 10% .The efficiency of drying depends upon the air flow rate, the thickness of the slice and the load per tray. The higher drying ratio in banana chips compared to plantain chips is expected because plantain has a lower moisture level. This is similar to observation reported by Kalkarini *et al.* (1995) for different varieties of potatoes.

Fig. 1 showed that there was a significant rehydration in slices of plantain than in of banana in distilled water. This may be due to the high content of starch. Rehydration by soaking dehydrated chips in boiling water increased the rehydration rates. The difference observed by the panelist in the colour of the compared to dehydrated could be due to the lower availability of water for gelatinisation of starch in dehydrated chips during frying process as compared to

fresh samples. The texture and the overall acceptability of chips made from rehydrated chips were significantly inferior to that of fresh samples. From the reported results in this study, it could be concluded that the nutritional value and the overall acceptability properties of dehydrated chips were better than those of the rehydrated dehydrated chips of both banana and plantain.

References

Agunbiade, S.O., 1992. The physical, chemical and nutritional characteristics of Africa yam bean (*Sphenostylis stenocarpa*) harms. Unpublished Ph.D Thesis of the University of Ibadan, Ibadan, and Nigeria, pp:132-133.

Asiedu, J.J., 1980. Foodstuff technology: the processing of plantain an example from Ghana. GATE 3:19-20.

Del Rosario, R.R. and D.M. Flories, 1981. functional properties of four types of mung bean flour.J.Sc. Food Agri., 32: 175-180.

Kay, D.E., 1987. The processing of banana products. So Pan Bull.2nd quarter, 17: 37-41.

Ketiku, O.A., 1973. Chemical composition of unripe and ripe plantain.J. Sci. Food Agri., 24: 703-707.

Kalkarini, K.D. N. Gorinden and D.N. Kulkarini, 1995. Crisp quality of two potato varieties; effects of dehydration and rehydration. J. Sci. Food Agri., 64: 205-210.

Lii, C.Y., S.M. Chang and Y.L. Young, 1982. J. Food Sci., 47: 1493.

Maor, I.G., 1958. Banana Rev.Sen.23 Indian Com.. Agric. Res. New Delhi.

Morton, J.F., 1987. Banana.In: Fruits of warm Climates. Julia F. Morton, Miami, FL 29-46.

Onyejugbu, C.A. and A.O. Olorunda, 1995. Effects of raw materials processing conditions and packaging on the quality of plantain chips.J. Sci. Food Agri., 68: 279-283.

Padmashree, T.S., L. Vuayalakshmi and S. Putharaj 1987. Effects of traditional processing on the functional properties of cowpea(*Vigna catjang*) flour. J. Food Sci. Tec., 24: 221-224.

Pearson, O., 1976. Chemical Analysis of Foods, 6th edt. Churchill Livingstone, London, pp: 6-12.

Quinn, J.R. and D. Paton, 1976. A practical measurement of water hydration capacity of protein materials. Cereal Chem., 56: 38-39.