International Scholars Journals

African Journal of Virology Research ISSN 3421-7347 Vol. 5 (9), pp. 001-004, September, 2011. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Full Length Research Paper

Microorganisms associated with the preparation of plantain pudding in Western Nigeria

Ohenhen, R. E., Enweani, I. B., Ogiehor, S. I. and Uwabor, K.

Department of Microbiology, Ambrose Alli University, Ekpoma, Edo State, Nigeria.

Accepted 24 April, 2011

The microbiological and physico-chemical quality of plantain pudding was evaluated during processing and storage under ambient temperature (30.5°C) for 120 h duration. Results indicates that the total viable bacteria count decreased from 1.36 x 10^5 cfu/g (raw sample) to 0.3 x 10^1 cfu/g after cooking and thereafter increase steadily to 1.05 x 10^8 cfu/g while the total fungi count decreased from 2.70 x 10^4 cfu/g to non detectable count after boiling but increase to 6.40 x 10^6 cfu/g at the end of the storage period. Seven bacteria genera; *Bacillus*, *Staphylococcus*, *Streptococcus*, *Pseudomonas*, *Klebsiella*, *Lactobacillus* and *Escherichia coli* and six fungi genera; *Fusarium* spp., *Aspergillus* spp., *Penicillium* spp., *Alternia* spp., *Geotrichium* spp. and *Cladosporium* spp. were detected and isolated. The pH decreased from 5.7 (raw sample) to 4.7 after boiling and thereafter decreased gradually till the end of the storage period while the titratable acidity increased slightly. Furthermore, the moisture content decreased steadily all through the storage period.

Key words: Microorganisms, preparation, plaintain pudding.

INTRODUCTION

Plantain (*Musa sapientum* var. Paradisiacal Linn) is one of the stable food widely consumed in the West Africa sub-region, Northern America, Mexico, and the Carib-bean. In Nigeria, its consumption cuts across the multi ethnic groups and the various socio-economic classes because of the ease of preparation and consumption. In roasted form (called bole), it is eaten with palm oil or groundnut. When boiled, it is eaten with vegetable soup or assorted stew. It is also fried into chips, making it a popular food item among the rich and the poor.

Plantain pudding prepared by mixing ripe and unripe plantain powder is one of the various food items derived from plantain. It is widely consumed by several millions of people in Southern Nigeria, especially in Edo State. Production methods and techniques vary from one locality to another resulting in a product of variable quality indices and shelf life. Furthermore, production process is laborious, cumbersome and time consuming. Despite the popularity of this relish food item, scientific information on the processing methods, microbiological and physico-chemical quality is hardly available. This study was designed to investigate the various changes associated with the microbiological quality of plantain pudding during processing and storage with the aim of developing data and indices for the production and processing of plantain pudding and possible industrialization.

*Corresponding authors E-mail: ibenweani@yahoo.com.

MATERIALS AND METHODS

Source of plantain and processing

Raw unripe and ripe plantain were obtained from the open market in Ekpoma, Edo State, Nigeria, and processed according to the traditional method. The unripe matured plantain were peeled, washed, sliced into flat sheet of 2-3 cm x 12- 14 cm with the aid of a sharp knife, sun dried for 3-5 days and then milled using a commercial milling machine and finally mixed with water (1 kg/2 litres) to form a slurry. In addition, the ripe plantain were peeled, cut into pieces and milled. The resultant paste was mixed with the unripe slurry, two cooking spoons of palm oil, seasonings such as salt, onions and others were added to taste and thereafter stirred vigorously to mix uniformly. The resultant slurry/paste was wrapped using previously sterilized plantain leaves and then boiled for 2 - 3 h. It was allowed to cool to room temperature. These were kept in the laboratory and monitored microbiologically at 24 h intervals.

Microbiological analyses

The various groups and types of microorganisms associated with plantain pudding were analyzed, enumerated and quantified according to the methods described by Harrigan and McCance (1976). 25 g of plantain pudding was aseptically weighed from each wrap and homogenized in 225 ml of 0.1% (w/v) sterile peptone water for 3-5 min in a Colwarth Stomacher (A.J. Seward and Co. London). Thereafter, tenfold serial dilution was prepared by transferring 1 ml of the homogenate into 0.1% (w/v) sterile peptone water as diluents. Further serial dilutions were carried out following this. 1 ml of appropriate dilutions were aseptically plated using the pour plate technique for total viable aerobic bacteria count on nutrient agar (Oxoid) and total viable fungi count on potato dextrose agar (Oxoid), supplemented with chloramphenicol. The various media used were prepared and incubated according to the manufacturer's instructions. At the end of the incubation period, the colonies were enumerated and expressed as colony forming units per gram (cfu/g). Isolation, characterization and identification of the associated microorganisms were carried out for qualitative determination using colonial, morphological and biochemical characteristics (Harrigan and McCance, 1976). The fungal isolates were identified based on examination of the colonial trends, phialides conidiophores and presence or absence of foot cells and rhizoids (Samson and Raneen-Hoekstra, 1988).

Physico-chemical analyses

pH: The pH was determined by homogenizing 10 g of the various samples in 20 ml of distilled water and using a referenced glass electrode pH meter (JENWAY 3020, England).

Titratable acidity (TA% lactic acid): This was determined by titrating 0.1 N sodium hydroxide against 10 ml of supernatant of homogenized sample, using phenolphthalein indicator as described by AOAC (1990).

Moisture content: The moisture content was determined by the oven dry method previously described by AOAC (1990).

RESULTS

Results of the changes associated with the microbiological and physico-chemical quality of plantain pudding during processing and storage at 30.5°C are shown on Tables 1- 3. The total viable bacteria count decreased from 1.36×10^5 cfu/g in the mixed uncooked sample to 0.3×10^1 cfu/g in the cooked sample at 0 h. Thereafter steady increase was recorded till the end of the storage period (1.05×10^8 cfu/g) at 120 h. Similar trend of change was recorded in the total viable fungi count which decreased from 2.70×10^4 cfu/g to lack of growth after cooking and thereafter increased gradually to 6.40×10^6 cfu/g at the end of the storage period (Table 1).

Vast array of microorganisms were detected and isolated during processing and storage. Seven bacteria genera (*Bacillus, Staphylococcus*, *Streptococcus*, *Pseudomonas*, *Lactobacillus*, *Klebsiella* and *Escherichia*) and six fungi genera (*Fusarium*, *Aspergillus*, *Penicillium*, *Alternaria*, *Geotrichum* and *Cladosporium*) were detected and isolated. Ecological succession was observed amongst the various organisms after cooking. The early phase was dominated by bacteria species while the later phase was dominated by fungi species (Table 2). Table 3 shows the changes associated with the physico-chemical quality. The pH decreased from 5.8 (raw mixed sample) to 4.7 after cooking and thereafter decreased gradually to 3.98 at the end of the storage period. Conversely, the titratable acidity increased after boiling from 0.01 to 3.98 at the end of the storage period. Similarly, the moisture content increased from 36.4% after boiling to 39.8% at the end of the storage period.

DISCUSSION

Changes in the microbiological and physico-chemical quality of any food item determines its safety, acceptability, shelf stability and its fitness for consumption. The results of the present work indicate noticeable changes, especially in the microbiological quality during processing and storage. The decrease recorded in the total viable count after cooking may be related to the effect of heat associated with the cooking process leading to death as a result of shock and homeostasis distortion. The steady increase recorded thereafter till the end of the storage period may be traced to recovery of injured cells, favorable micro environmental condition and nutrient availability. Similar report has been documented for other related food items (Ogiehor et al., 1998, 1999; Gould, 1988).

The vast array of microorganisms detected and isolated in the raw sample prior to cooling may be due to contamination of cooking utensils, water for mixing, knife for peeling, mixing equipment, sneezing and coughing by handlers and leaves used for packaging. Production of most traditional food is often associated with unhygienic practices. This has been documented for some other food items (Ogbulie et al., 1993; Njoku et al., 1990; Ogie-hor et al., 2004). However, the fewer numbers recorded after processing may be associated with the various effects of the processing conditions.

The continuous decrease recorded in the pH may be due to high microbial activities leading to breakdown of the various components to organic acid and other compounds. This may also be responsible for the slight increase recorded in the titratable acidity. Furthermore, the resultant low pH may be responsible for the ecological succession observed amongst the associated microorganisms with the fungi groups which tolerate low pH dominating the later phase of the storage period. This finding supports reports for other food items (Ogiehor et al., 2003, 2005). In addition, the increase recorded in the moisture content may be traced to the high microbial activities which help to distort the texture and breakdown the various components leading to liquification.

This study has shown that obvious microbiological and physico- chemical changes are associated with plantain pudding during processing and storage. Results and data obtained can be harnessed for developing durable indices for the processing and handling of this relish food item.

Table 1. Total viable count (cfu/g) of plantain pudding during processing and storage.

Storage period (h)	Mixed unboiled sample		Boiled sample	
	Bacteria	Fungi	Bacteria	Fungi
0	$1.36x10^5$	$2.70x10^4$	$0.30x10^1$	NG
24			$6.70x10^1$	$0.50x10^1$
48			$1.10x10^3$	$2.20x10^2$
72			$2.10x10^5$	$4.20x10^4$
96			$1.16x10^6$	$9.60x10^5$
120			$1.05x10^8$	$6.40x10^6$

Table 2. Distribution of microorganisms isolated from plantain pudding during processing and storage.

Microorganisms	Mixed Unboiled	Boiled					
		0 h	24 h	48 h	72 h	96 h	120 h
Bacteria group							
Bacillus	+	+	+	-	-	+	-
Staphylococcus	+	-	+	-	-	+	-
Streptococcus	+	-	+	-	-	+	-
Pseudomonas	+	-	+	-	-	+	-
Klebsiella	+	-	+	-	-	+	-
Lactobacillus	+	-	+	-	-	+	-
E. coli	+	-	+	-	-	+	-
Fungi group							
Fusarium	+	-	-	-	+	+	+
Aspergillus	+	-	+	+	+	+	+
Penicillium	+	-	-	+	+	+	+
Alternaria	+	-	+	+	+	+	+
Geotrichum	+	-	-	+	+	+	+
Cladosporium	+	-	-	-	-	-	-

Table 3. Physico-chemical quality of plantain pudding.

Microorganisms	Mixed Unboiled	Boiled					
		0 h	24 h	48 h	72 h	96 h	120 h
pH	5.80	4.70	4.40	4.20	4.10	4.05	3.98
TA	0.00	0.001	0.001	0.002	0.002	0.002	0.003
MC	46	36.4	36.8	38.4	38.9	38.6	3.98

TA, Titratable acidity; MC, moisture content.

REFERENCES

AOAC (1990). Official methods of analysis. 11th Edition. Association of fficial Analytical Chemists. Washington D.C. 595 pp.

Gould GW (1988) Interference with homeostasis. In: Homeostatic Mechanisms in Microorganism. Whittenbury R, Gould GW, Bank JF, Board JF (eds) FSM Symposium 170 (44) 220-228

Harrigan WF, McCance ME (1976). Laboratory Methods in Food and Dairy Microbiology. Academic Press. London pp416

Njoku HO, Ogbulie, JA, Nnumbia C (1990) Microbiological Study of the Traditional Processing of the African Oil Bean (*Pentaclethra microphyllia Bentham)* for Ugba production. J. Food Microbio. 7: 13-26.

Ogbulie JA, Ogiehor SI, Isu NR (1993). Effect of chemical and physical treatment on the shelf life of fermented African Oil Bean Seed (Ugba). Nig. J. Microbio. 11:168-178

Ogiehor SI, Owhe-Ureghe UB, Momodu IO (1998) Microbial, Chemical and Organoleptic quality of palmwine preserved by combinations of preservatives. Nig. J. Microbio. 12:63-68

Ogiehor SI, Ohenhen RE, Okwu IG, Agbonlahor FE (1999). Production of Food Condiment (Sauce) from African Oil Bean *(Pentaclethra microphylla – Bentham)* and preservation by combined application of

temperature and sodium chloride. Nig. J. Microbio. 13:87-94
Ogiehor SI, Iyamu MI, Ize-Iyamu O (2003). Biodeterioration of Akpu produced from cassava *(Mannihot esculenta – Crantz)* and the effect of sodium benzoate alone or in combination with ascorbic acid. Advances in Natural and Appl. Sci. Res. 1. (1): 1-19
Ogiehor SI, Ikenebomeh MJ, Momodu IO (2004) Quality characteristics of Market garri destined for consumption in ten selected status: Baseline for Industrialization. Advances in Natural and Appl. Sci. Res. 2 (1): 17-25
Ogiehor SI, Ekundayo AO, Okwu GI (2005). Shelf Stability of Agidi produced from Maize *(Zea mays)* and the effects of sodium benzoate treatment in combination with low temperature storage. African Journal of Biotechnology 4(7): 743-748
Samson, R.A. and Raneen-Hockstra, E.S Van (1988) Introduction to food borne fungi, 2nd ed. Central bureau voor schimmel cultures boarn.