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Studies on nutrient contents and microorganisms associated with 'Dodo Ikire', a plantain snack from Western Nigeria

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ABSTRACT: A survey of microflora of locally sold plantain based convenience food 'odo ikire' was carried out and the chemical composition of this indegenous food was also investigated. Microorganisms isolated and characterized from this locally prepared food product include Bacillius subtilis, Bacillius cereus Staphylococcus aureeus, Escherichia coli, Aspergillus niger and Rhizopus spp. Proximate chemical analysis revealed that 'dodo ikire' was rich in lipids, sugar, starch, protein, crude fibre and ash contents. Mineral elements such as sodium, potassium, calcium, magnesium, phosphorus and zinc were also founf to be present in very small quantities. The result obtained were discussed in relation to food value and microbiological quality of 'dodo ikire'.

Key Words: Convenience foods; 'Dodo Ikire'; Microbial contamination; Food microbiology.

Introduction

'Dodo ikire' (Plantain snack) is an indigenous food that is consumed mostly by Yoruba people of the South-Western Nigeria. It probably originated from Ikire (a town in Osun State) where it is produced and consumed in very large quantities hence the name 'dodo ikire'. It is sold by mobile food vendors in market places or hawked around the major road so as to gain the attention of the travellers to buy.

Dodo ikire' is produced from overripe plantain (*Musa sapientum*) with the addition of some other condiments like *Capsicum annum* (pepper), *Allium cepa* (onion) and sodium chloride(Table salt). Ogazi (1982) suggested that the quality and maturity of plantain is of paramount importance for the production of any plantain based convenience food. Thorner (1973), defined convenience foods as pre-prepared which can be served with little or no preliminary preparation apart from heating and cooling to increase their palatability.

Varieties of processed from locally available food materials by traditional methods have not been properly documented. This shortcoming is one of the factor largely responsible for the little progress in the improvement of our traditional processing techniques. Up till now, the public consumers of these product have not been properly guided because of the availability of few published independent scientific assessment of these indigenous food materials.

Therefore, the objective of this present study is to provide information on the nutritive values as well as microbiology quality of 'dodo Ikire'.

Material and Method

Locally processed 'dodo ikire' samples used for these studies were purchased at Ibadan, Ikire and Oshogbo from vendors who usually hawked them around along the major road. Samples were collected in sterile polythene bags and taken to the laboratory under aseptic condition.

For the laboratory prepared 'dodo ikire', overripe plantain (Musa Sapientum) were kept in a sack for 5 days in the dark for it to overripe. It was peeled and sliced into tiny pieces.two litres of palm oil was heated to temprature of about 160^{o}C. sliced plantain (500g), Capsium annuum, (5.0g), Allium cepa (5.0g) and 1.0g of sodium chloride was added. The frying process was allowed until the color of the paste changed to dark brown. The fried snack was moulded in a sterile funnel and was allowed to cool before packaging inside a sterile polythene bags. Both the laboratory prepared 'dodo Ikire' and other samples purchased were subjected to microbiology and chemical analyses.

Microbiology Analysis

Ten grams of each of the samples homogenized completely in 9ml of sterile de-ionized water (i.e. 1:10 dilution) inside sterile conical flask and was shaken vigorously. Seven fold serial dilution was made using the method of Ejiofor and Okafor (1985). The homogenate was used to determine bacteria number, pH and isolation of microorganisms.

A Pasteur pipette used to transfer 0.25 ml of the last three dilution on to a sterile plates of nutrient agar (N.A) (Oxoid), Eosin methylene blue agar, (EMB) (Difco) and Potato dextose Agar (PDA) (Oxoid). The plates were agitated for even spread of the inoculum and incubated at 37^{0}C for 24 hours for bacteria and 30^{0}C for 72 hours for fungi. Colonies that appeared at the end of incubation were counted and the units were expressed in term of colony forming unit per gram of the sample (cfu/g).

The distinct visible colonies were Gram stained examined under oil immersion objective. The colonies were then streaked on to appropriate agar to obtain pure cultures. the isolates were was subjected to standard biochemical tests shown in table 3. Bacterial characterization were carried out on the microorganism by comparing the result obtained with standard characterization definitions of Skerman (1967) and that of Berges' manual of determinative bacteriology (1974). Fungi identification was carried out by colonial morphology or solid agar and microscopic examination. The were interpreted after comparing them with the standard with standard description of Alexopolous et al.(1996).

Proximate Analysis

Pasted samples of 'dodo ikire' were oven dried at 80^{0}C for 72 hours and powdered in a moulinex blender. The fine powdered samples was used for proximate analysis. The loss in weight after oven drying weighed fresh samples at 80^{0}C for 72 hours was taken as the moisture content. Ash content was determined by adding 3g of powdered samples inside the crucible of known weight and ashed in a Gallenkamp furnance at 550^{0}C for 6 hours after which it is cooled and weighed. (Fasidi and Kadiri 1993).

For sugar, starch, protein, fat, crude fibres and mineral element contents, analysis were carried out at the International Institute of Tropical Agriculture (I.I.T.A) Ibadan. Each sample was coded so that analysts were unaware of their identities. Sugar content was determined by phenol-sulfuric acid method of Dubos *et.al.* (1956), as contained in I. I. T. A. manual (1979). Starch content was quantified by anthrone method of A.O.A.C.(1990). Protein content was determined using folin phenol reagent of Lowry *et.al.* (1951). Soxhlet extraction method of Dubois *et. al.* (1956), was used to analyze lipid content, while crude fibre was determined according to A.O.A.C. method (1990). All the essential elements were analyzed using atomic absorption spectroscopy and flame photometry methods as contained in I.I.T.A. manual (1979).

Results and Discussion

Table 1 shows the proximate composition of all 'dodo ikire' samples. The apparent moisture content was relatively high (ranged from 51.9% to 54.6%) with the average of 53.2%. The high moisture content is an indication that 'dodo ikire' cannot keep for long time because high water activity enhance microbial growth

(Brock *et al*., 1986). This result is in agreement with the findings of Ogazi (1982), who obtained high moisture content in plantain pulp.

Table 1: Percentage Food Contents of 'Dodo ikire' Obtained at Different Locations

Dodo Ikire Sample	Apparent Moisture Content	Dry Matter Content	Sugar Content	Starch Content	Protein Content	Lipid Content	Crude Fibre Content	Ash Content
	A	B	C	D	E	F	G	H
Ibadan	52.3a	47.7a	25.1b	30.4a	5.5b	1.2b	1.2a	3.8b
Ikire	54.6b	45.4b	27.5a	32.3a	5.6b	15.3a	0.9b	3.7b
Osogbo	51.9a	48.1a	24.6b	29.7a	5.4b	13.7b	1.3a	4.0a
Prepared	53.8b	46.2b	26.5a	31.8a	6.0a	16.0a	1.0b	3.5c
Averages	53.2	46.8	25.9	31.1	5.6	14.8	1.1	3.8

*Data are means of 3 replicates calculated as % dry weight (except A and B fresh weight).

Means followed by the same letter(s)s within any column are not significantly different by Duncan's multiple range test (P = 0.01).

The starch content was 31.1% while the sugar content was 25.9% (Table 1). These values were different from those obtained by Ketiku(1974), who observed high sugar and low starch contents in ripped plantain pulp. The reduced sugar content in 'dodo ikire' may be as a result of overripe plantain used in its preparation. Nieva *et. al.* (1970), suggested that overripe plantain undergo fermentation during which some sugars broken down.

The total lipid content was moderately high (average 14.8%) (Table 1). The composition of lipid, starch and sugars in 'dodo ikire' suggested that it is an energy giving food. The high content may be linked to red palm oil used in the frying process. 'Dodo ikire' contained considerable amount of protein (Table 1). The average protein composition of 'dodo ikire' may be due to the condiments added to its preparation. It was observed that the laboratory prepared 'dodo ikire' had protein content of 6.0% while Ikire, Ibadan and Oshogbo samples had 5.6%, 5.5% and 5.4% respectively. These little variation was as a result of varying amount of materials used at different places.

Table 2 shows the mineral elements composition of 'dodo ikire'. Sodium was the most abundant mineral nutrient in the samples. This high sodium content may be due to sodium chloride added during the preparation. This food is also rich in Zn and K while minerals like Ca, Mg, P, Fe, Cu, and Mn, were found to be present in very small amount. The result implies that 'dodo ikire' is a complete food that can be taken to generate energy and for maintenance of normal chemical activities of the body.

Four bacteria and two fungi were culture from 'dodo ikire' (Table 3 & 5). They were tagged isolates A, B, C, D, E, and F. these microorganisms were identified as *Bacillus cereus*, *Bacillius subtilis*, *Staphylococcus aureus*, *Escherichia coli*, *Aspergillus niger* and *Rhizopus* spp. A simplified classification based on morphology, endospore formation, starch and gelatin hydrolysis, nitrate reduction anerobic growth medium were used to classify the mesophilic spore formers (isolate B) could be differentiated by its motility sand positive reaction on methyl re (Berge's manual 1974).

Isolate C was identified as *Staphylococcus aureus* because the cells positive cocci in clusters. The organism also ferment mannitol strongly and coagulates test was positive (Table 3). Isolate D was gram negative short rod which ferment lactose. It growth on Eosine methylene blue agar to form green metalic shen was used to classify it as *E. coli* (Brock *et al* 1986). The properties of fungi isolated (isolates E&F) are shown in Table 5. The two isolates showed enough morphological and microscopial characteristics to be

grouped as *Aspergillus niger* and *Rhizopus* spp. (Alexopolous *et al* 1996). The pH, of 'dodo ikire' ranged between 5.28. this suggests that it is an acid food. This may be the reason why it supported the growth of bacteria and moulds (Brock *et al* 1986). Apart from the laboratory made sample, the microbial load of other samples were high (Table 4). These results suggested that 'dodo ikire' sold at three locations are heavily infested with microorganisms which may pose health risk to the consumers public.

Table 2: Mineral Nutrient Content of 'Dodo Ikire' obtained at Different Locations

Dodo Ikire Sample	Ca	Mg	P	K	Na	Fe	Zn	Cu	Mn
Ibadan	0.06b	0.11a	0.40a	1.0d	5.6a	0.08a	2.5b	0.02a	0.06c
Ikire	0.09a	0.13a	0.30a	1.3b	5.1b	0.09a	2.2c	0.04b	0.10a
Oshobgo	0.05b	0.10a	0.20a	1.2c	4.9b	0.07a	2.3c	0.03a	0.09a
Prepared	0.08a	0.12a	0.30a	1.4a	5.7a	0.09a	2.8a	0.0a	0.07b
Average	0.07	0.12	0.30	1.2	5.3	0.08	2.5	0.03	0.08

*Data are means of three replicates expressed in mg/g.

Means followed by the same letter(s) within any column are significantly different by Duncan's multiple range test (p = 0.01).

The isolation of *Bacillus subtilis* and *B. cereus* from the samples is an indication of fermentation. This is because Kolawole and Okonkwo (1985), Popoola and Akueshi (1985), Okafor (1977) and Akinrele (1970) isolated similar organisms while studying fermentation of 'daddawa;, 'ukpala', and maize respectively. *S. aureus* isolated from Ibadan and Oshogbo samples (Table 3) may be due to unhygienic handling of materials during or after processing. The pathogenic strains of *S. aureus* have been implicated in food poisoning. The implication of taken 'dodo ikire' contaminate by this organisms may be serious. The isolation of *E. coli* from Ibadan samples is an indication of fecal contamination. This may be as a result of post processing contamination caused by the local producers and seller.

Moulds (*Aspergillus niger, Rhizopus* spp) were also isolated from the samples. The reason for fungal growth may be attributed to the high nutrient contents of 'dodo ikire'. The spoilage on 'dodo ikire' by microorganisms could be traced to the practice of air-cooling of the fried snack before package into polythene bag. Since 'dodo ikire' have been proved to be an highly nutritious food, studies on the method of preservation of this locally made food should be carried out. Local producers and sellers of this food could also be advised on a simple hygienic way of material handling, so as to prevent the entrance of pathogenic organisms. This will definitely prevent health hazard among the public consumers of this food product.

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Table 3: Properties and Probable identities of bacteria species isolated from 'Dodo Ikire'

Isolates	Colony Morphology N.A	Cell Characteristic	Litmus milk	Motility	Endospore	Indole	Gelatin	Starch	Nitrate	M.R	V.P	Oxidase	Coagulates	Glucose	Sucrose	Fructose	Lactose	Mannito	Maltose	Raffinose	Probable Identification	Sample source
A	Flat whitish colony	Gramti e long rods	+	-	+	+	+	+	+	+	-	+	-	+ G	+	+ G	-	-	+ G	+	Bacillus Cereus	Ibadan Ikire Oshogbo
B	White dry surface colonies slightly raised	Gram tive short rod	+	+	+	+	-	+	+	-	+	+	-	+	+	+	+	-	+	+	Bacillus subtilis	
C	Whitish Yellow colonies with smooth growth and the entire edge	Gramti veCocc ilin	-	-	-	+	-	+	-	+	-	+	+	+	+ G	-	+	+	-	0	Staph Ococcus aureus	Ibadan Oshogbo
D	Smooth convex colonies	Gramti ves short rods	-	+	-	-	+	+	-	-	+	-	+	-	+	+ -	-	-	-	+	Escheric hia Coli	Ibadan

Key

+	Positive with acid production only
±	Weakly Positive
-	Negative
O	not Tested
G	Ges Production

Table 4: Viable Bacteria Count and pH of 'Dodo Ikire' Obtained from Different Locations

Place of Sample Collection	Bacteria Count (CFU/g)	pH
Ibadan	5.20×10^5	5.11
Ikire	4.80×10^5	5.10
Oshogbo	3.40×10^5	5.02
Laboratory Prepared Sample	-	5.28

Table 5: Properties and Probable Identities of Fungi Isolated From 'Dodo Ikire'

Isolate	Colony Morphology	Generals Microscopic Morphology	Detailed microscopic Morphology	Probable Identify	Source
E	Colonies appear greenish yellow on potato dextrose Agar with vivid pigment	Hyphea are Septate and branched	Coindiophores are simple rough and upright terminating in a globose swelling only Primary sterigma radiate from the vescle and chains of conidia arise from them.	*Aspergillus niger*	Ibadan Ikire and Oshogbo Samples
F	Dirty white cottony colony which spreads rapidly on PDA	Hyphae branch freely and are non septate	Rhizoids are formed along the length of myceliums. Sporangiophores are joined by stolon. Spores vary in shape but, are generally ovoid	*Rhizopus spp*	Ibadan and Ikire Samples

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