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Full Length Research Paper

Impact of traditional processing methods on some physico chemical and sensory qualities of fermented casava flour "Kpor umilin"

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The study was conducted to investigate the effect of traditional processing/preservation methods on the physico-chemical and sensory quality of fermented cassava flour (Kpor umilin) in some areas of Benue State, Nigeria. The physical, chemical and organoleptic qualities of the traditionally processed flours were determined by standard methods in samples collected from five locations in the state. This was then compared with flour sample prepared in the laboratory from a modification of the traditional process. It was observed that the traditional sample contained higher moisture (14.15% - 16.81%) than the modified sample (13.85%). Viscosities of the traditionally processed flours varied from 15.50 cP – 48.00 cP as compared to 17.00 cP for the modified flour sample. The bulk densities and swelling properties of the traditionally processed flours were however similar to those of the modified flour. Hydrogen cyanide (HCN) content of the traditionally processed flours was higher (9.90 mg/100 g - 15.00 mg/100 g) than in the modified flour (6.40 mg/100 g). The pH of the samples were similar but titratable acidity (TTA) values varied significantly (P<0.05) among the samples. Physical contaminants including hairs, feathers, insect parts, stones and others were about 2% in flour from the modified process and 16 – 46% in the traditionally processed flours. 'Fufu' samples from the modified method was significantly (P<0.05) better than those from the traditional methods with respect to colour/appearance, odour and texture. The quality of the traditionally processed products was generally poor and this calls for urgent need to educate traditional processors on good manufacturing practices, adopting the upgraded modified process.

Key words: Traditional processing, fermented cassava flour, Kpor umilin.

INTRODUCTION

Cassava is a major supplementary food for people in tropical areas as a source of calories. In Nigeria, cassava tuber at harvest is processed locally into "gari", "fufu", 'kpokpo gari' and fermented cassava flour "kpor umilin". "Kpor umilin" is prepared by fermenting the peeled cassava root for 3 - 5 days. The fermented pulp is made into puree, dried and packed for use. When required, it is usually pounded or milled and sieved into fine flour.

The fermented flour is known to be low in hydrocyanic acid (HCN) content with a longer shelf-life and generally more preferred than the unfermented flour (Bokanga, 1991). Fermented cassava flour ("kpor umilin") is traditionally processed by the rural uneducated women. Potable water is often not available in these rural areas. As a result, the processors rely on stream or well or pond waters whose qualities are usually very poor. The products are therefore usually of low hygienic quality (Kareem et al., 1990). There is usually large amount of losses during the processing and preservation of the flour. Apart from the peeling losses, a lot more losses (over 40%) occur during the drying of the puree. The puree is often dried on bare concrete floor along the roadside, on aban-

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Table 1. Some physical properties of traditionally and laboratory femented cassava flour "kpor Umilin".

Sample Source	Moisture (%)	Viscosity (CP)	Bulk density (gkms)		Swelling index (%)	
			Loose	Packed	Room water 29 ± 1 ^{0}C	Hot water 70 ± 1 ^{0}C
Gboko	15.76	17.50	0.30	0.56	24.33	27.83
Katsina-Ala	14.15	48.00	0.03	0.51	29.00	33.30
Makurdi	16.81	17.00	0.29	0.51	22.33	25.00
Oju	14.38	36.00	0.32	0.53	25.00	30.33
Otukpo	16.65	15.50	0.28	0.59	22.00	23.67
Laboratory Sample	13.53	17.00	0.29	0.49	23.00	26.00

doned tarred roads, on naturally rocky surfaces or within residential compounds. Here, the products are exposed to dust, animals (e.g., lizard, sheep and goats), birds such as ducks and hens, and flies and roaches which feed and defecate on them. The animals consume much of the products during drying on the bare floor. A large quantity of the products are also never recovered during packing after drying, as they mix with sand or are scattered into the nearby bush. Sometimes a sudden rainfall might wash away a whole day's labour. Often, the products are moudly and discoloured because of insufficient drying and enzymatic action.

In this report, the traditional processing and preservation method was modified to improve the quality of fermented cassava flour (kpor umilin). The microbiological quality of the fermented cassava flour has been previously reported (Tsav-wua et al., 2004). This paper, therefore, presents the results of some physicochemical and sensory qualities of the improved as well as the traditionally processed/preserved flours.

MATERIALS AND METHODS

Traditional processing of "kpor umilin"

The various methods of traditional fermentation of kpor umilin has been reported (Tsav-Wua et al., 2004). For the investigation, samples of the traditionally processed and preserved "kpor umilin" was randomly purchased twice from the local processors in each of the study areas namely Gboko, Katsina-Ala, Makurdi, Oju and Otukpo at interval of 4 weeks. The samples were aseptically packaged in a pair of new polythene bags and brought to the laboratory. They were stored at ambient temperatures of 30 ± 1^{o}C, before being used for physical and chemical analyses. Sensory evaluation of the "fufu" paste prepared from them was also carried out.

Preparation of the laboratory modified "kpor umilin"

The laboratory fermented cassava flour (kpor umilin) was prepared using the modified traditional method described by Tsav-Wua et al. (2004). The modification involved several washing steps and use of potable water throughout production. The pulverized cake/mash was dried in a solar dryer under very hygienic conditions as opposed to the sun drying in the open by the traditional processors.

Analytical methods

The pH and titratable acidity of the flour samples were determined by the method described by Pearson (1976). Moisture content was determined by the air-oven method according to AOAC (1984) procedure. Viscosity was determined as reported in AOAC (1984) procedures except that it was not acidulated with 1 N lactic acid and no anti-foaming agent was used.. HCN content of the samples was estimated using procedures of Balagopalan et al. (1988). Bulk density was carried out as reported by Banigo and Akpapunam (1987) and swelling index was by the method described by Ukpabi and Ndimele (1990).

Enumeration of physical contaminants

The physical contaminants in the traditionally and laboratory modified samples were evaluated by modifying the method reported in AOAC (1984) for wheat flour. The samples were milled and duplicate 50 g of each sample was weighed and transferred to 1.000 mm laboratory test sieve. The sieve was gently sifted until no more flour passed through. The residue was transferred onto clean plain sheet/paper and closely examined with a hand lens. Visible contaminants such as insect parts, feathers, hairs and stones were recorded and totalled.

The percentage (%) contamination per sample was calculated from the relationship: % Contamination = (Total number of contaminants / Weight of sample) x 100.

Preparation of "fufu" paste for sensory evaluation

38.44 g of flour sample was poured into 100 ml of boiling water in a stainless steel pot and stirred vigorously and thoroughly with wooden stirrer into a thick and moderately strong 'fufu' paste. The paste along with that adhering to the stirrer and pot was removed and transferred into clean stainless steel plate. This procedure was followed for all samples under investigation. 'Fufu" paste samples were appropriately coded for sensory evaluation which was conducted in line with the recommendations of Ihekoronye and Ngoddy (1985).

RESULTS AND DISCUSSION

Table 1 shows the results of some physical properties of both the traditional and modified kpor umilin samples. The moisture content of the traditional sample ranged from 14.15-16-82% as opposed to the 13.58% in the flour from the modified process. In a related study, Ukpabi

Table 2. Relative hydrocyanic acid content (HCN) pH and Titratable Acidity (TTA) of the Traditional and Laboratory femented Cassava flour "kpor Umilin".

Sample Source	Relative HCN Content (mg/100g)	pH	Titratable Acidity (TTA % lactic)
Gboko	11.90	6.66	0.09
Katsina-Ala	9.90	6.52	0.81
Makurdi	15.50	5.93	3.82
Oju	11.10	6.30	0.77
Otukpo	13.80	6.10	4.09
Laboratory Sample	6.40	6.82	0.34

Table 3. Physical Contaminants in Fermented Cassava flour ("Kpor Umilin") Samples.

Sample Sources	wt. of sample (g)	wt.of residue (g)	Physical contaminants					% Contaminant
			Hairs	feathers	Insect parts	Debris*	Stones	
Gboko	50.00	8.25	1	1	1	0	5	16
Katsina-Ala	50.00	7.06	4	3	3	1	9	38
Makurdi	50.00	9.03	4	1	1	3	9	46
Oju	50.00	7.30	3	2	2	2	8	38
Otukpo	50.00	8.77	1	2	2	2	4	20
Laboratory	50.00	4.62	0	0	0	1	0	2

*Materials such as leaves, grass and stalks

and Ndimele (1990) reported that "gari" sample with moisture contents of 14% and above had poor shelf-life. It is therefore possible that the traditionally processed flours may have poor storage life. However, Ketiku et al. (1978) considered their product with 15.5% moisture safe for storage without risk of spoilage. Ingram and Humphries (1972) had suggested that the water content of the final product should be 12%. This is impracticable with the traditional processing methods due to the humid conditions that exist locally. This can also explain the low moisture observed with the modified sample that employed a solar dryer under controlled humid environment. The pH of the samples were similar but the titratable acidity (TTA) values varied significantly ($P<0.05$) among samples.

The viscosity of flours from the various locations was closely related except for samples from Katsina-Ala and Oju study areas with very high viscosity values. This could be a reflection of poor processing methods adopted by the processors in those places. The packed density of the traditionally processed flours was slightly higher than the modified sample. The lower packed density of the flour from the modified process could be an advantage in packaging of the flour (Okezie and Bello, 1988). It could also be an indication of better processing method in the modified process.

The relative HCN content of the traditional "kpor umilin" from the five research areas ranged between 9.90 and 15.00 mg/100 g against the low content of 6.40 mg/100 g obtained for the laboratory modified method (Table.2). The recorded variations in the traditional samples could be attributed to defective processing conditions such as inadequate fermentation, inadequate drying of the puree and the use of high cyanide local varieties of cassava. The values conformed to the reports of Ukpabi and Ndimele (1990) and Omueti et al. (1993) from "gari' samples. Ketiku et al. (1978) also reported HCN content of 19.6 mg/kg in their cassava flour "lafun". The HCN content of the traditional and modified flour samples in this study was within safe limits recommended for consumption (Fukuba and Mendoza, 1984). The lower HCN in the modified sample is advantageous and could be an indication of the adequacy of the modified process especially with the use of the solar dryer at the drying stage.

Physical contaminants in the flours included hairs, feather, insect parts, stones and others (Table 3). The percentage contamination of the flours ranged from 2% in the modified laboratory sample to 46% in the sample from Makurdi study area. The high contamination in the traditionally processed flours could be due to the traditional practice of floor drying with little or no protection for the drying samples. The modified sample was however exceptionally low with only 2% contamin-ation which should be expected as a result of the modern food sanitary practices exhibited in the process, coupled with the use of solar dryer and appropriate packing / packaging of the dried mash. The presence of physical contaminants in general as seen in the traditional samples is an indication of poor processing conditions in accordance with report of Kareem et al. (1990).

There was marked difference ($P< 0.05$) (with respect to preference and overall acceptability) between "fufu" paste

Table 4. Sensory Evaluation of cassava "fufu" paste prepared from traditionally and laboratory fermented flour ("Kpor Umilin")*.

Sample Source	Colour/ Appearance	Odour	Texture	General Acceptability	Aggregated Mean
Gboko	1.50 ± 0.08^{c}	3.08 ± 0.07^{c}	2.92 ± 0.34^{6}	1.83 ± 0.15^{a}	2.35 ± 0.32
Katsina-Ala	1.67 ± 0.05^{c}	4.08 ± 0.70^{ab}	3.42 ± 0.51^{a}	2.08 ± 0.51^{a}	2.08 ± 0.37
Makurdi	4.17 ± 0.15^{ab}	4.00 ± 0.37^{ab}	2.75 ± 0.58^{b}	3.92 ± 0.23^{b}	3.71 ± 0.33
Oju	3.17 ± 0.10^{c}	2.42 ± 0.39^{c}	3.08 ± 0.14^{b}	2.58 ± 0.39^{a}	2.81 ± 0.26
Otukpo	4.42 ± 0.13^{ab}	3.25 ± 0.22^{c}	3.08 ± 0.61^{b}	3.50 ± 0.18^{b}	3.56 ± 0.29
Laboratory Sample	5.92 ± 0.02^{a}	5.17 ± 0.36^{a}	4.92 ± 0.50^{a}	5.75 ± 0.06^{c}	5.44 ± 0.24

* Means and std error a, ab, b and c = mean same superscripts are not significantly different at 5% level of probability using Tukey's test

prepared from the laboratory modified flour and the traditional flour samples (Table 4). The overwhelming acceptablitiy of the "fufu" from the modified sample could be due to the standardization of the production process which involved simple food sanitary and hygienic practices. This also accounted for the better microbiological quality of the flour from the modified process (Tsav-Wua et al., 2004).

It is evident from the study that the "kpor umilin" produced by the traditional methods is of poor hygienic quality with unacceptable organoleptic qualities. It is important to note that the developed modified method used seems to be much quicker than the traditional one as fermentation was for only 48 h. Also, there was an improvement on the sanitary/hygienic standards and organoleptic qualities of the modified product especially with the use of potable water for processing and solar dryer for drying. The box-type of solar dryer used was locally constructed and inexpensive. The top was convered with polyethylene sheet and the sides lined wth wood stuffed with sawdust in between as insulator to retain the heat energy trapped for a while, but with a vent to release some heat when the temperature within rises above the required temperature. Local processors should endeavour to adopt this new method as they will reduce the cost of the products by a reduction in the losses that would have resulted from uncontrolled and exposed sun drying.

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