JHER Vol. 20, September 2014, pp. 63-69

Indigenous Ways of Preserving Wet Corn Paste *(Ogi)* for Family Use

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Abstract

The study assessed the indigenous ways of preserving corn paste (Ogi). Effect of different storage conditions on pH, acidity, microbial content and sensory qualities of the corn paste (Ogi) were examined as well as the sensory qualities of the corn paste (Ogi) measured using 9-point hedonic scale. Data collected were analysed using Analysis of Variance (ANOVA). Result revealed that there was no significant difference ($p < 0.05$) in the pH content of the wet corn paste (Ogi) kept in covered plastic (A) and sealed cellophane (B) stored under ambient temperature. pH content was found to reduced significantly from 7 through 14 days. Although further reduction was noticeable in day 21, it was not significant ($p < 0.05$). Besides, no significant difference occurred ($p < 0.05$) in the acidity of wet Corn paste (Ogi) until the 14^{th} day of treatment irrespective of the storage condition (either kept in refrigeration or in ambient temperature). Another revelation of the study is that corn paste (Ogi) (corn paste) sample stored in the refrigerator had reduced fungi and bacterial counts (at most 1.5×10^6 and 1.2×10^4 respectively) when compared with samples stored in ambient condition (at most 4.0×10^6 and 2.5×10^4 respectively) which indicated that the refrigeration temperature reduced or inhibits the fermentation processes of the Corn paste (Ogi) samples. Corn paste (Ogi) kept in sealed cellophane and stored in the refrigerator was found to be the most accepted with respect to overall acceptability.

Key words: Indigenous, Ways, Preservation, Corn, Paste, Family.

Introduction

Corn paste (*Ogi*) is popular in Nigeria and in most of West Africa and produced traditionally from maize, sorghum or millet. It is prepared by steeping clean grains in water at room temperature (25+2^{o}C) for 48-72 hours (Omemu, 2011). The steep water is decanted and the fermented grain is washed with clean water and then wet-milled. In processing of maize, sorghum or millet into corn paste (*Ogi*) , the bran is removed by wet sieving and the sievate is allowed to settle for another 24-48 hours. This process is referred to as souring during which time fermentation also proceeds and the solid starchy matter, corn paste (*Ogi*), sediments.

Corn paste (*Ogi*) is a sour fine paste beverage which when cooked produces a thin semi-solid porridge. Corn paste (*Ogi*) porridge has a smooth texture and a sour taste resembling that of yoghurt (John et al., 2012). Corn paste (*Ogi*) has various uses and is consumed in varieties of forms.

According to Omemu and Adeosun (2010), corn paste (*Ogi*) is traditionally produced and marketed as a wet cake wrapped in leaves or transparent polythene bags. It is either boiled into a thin porridge, "pap", or a thick porridge, "*eko*" *or* "*agidi*", before consumption. However, substantial nutrient has been reported in processing corn paste to "*eko*" or "*agidi* (Hamad and Fields, 2009; Oke, 2001) necessitating discovering new way of processing the paste.

Corn paste (*ogi*) accounts for as much as 77% of total caloric consumption in Nigeria (Mitchell and Ingro, 2007), and contribute substantially to dietary protein of Nigeria citizens. Nutritionally, Corn paste (*ogi*) is an important source of dietary protein, carbohydrates, the B complex of vitamin E, iron, trace minerals, and fiber (Chaven and Kadam, 2003; 2008).

Being a staple Nigerian diet, corn paste (*Ogi*) is widely used as the first native food given to babies at weaning to supplement breast milk. It is also a palatable breakfast for pre-school, school children and most adults. As a weaning food, it is mainly patronized by the low-income earners because of high cost of imported infant formulations. Corn paste (*Ogi*) is equally consumed as a main meal for convalescing patients due to its easy digestibility (John, Okara and Osita, 2012).

Corn paste (*Ogi*) is now being processed using both modern and traditionally methods. The traditional method is a batch process carried out on a small scale for domestic use or as a commercial venture by some housewives. Specifically, Umo and Fields (1981) outlined the procedure as follows:

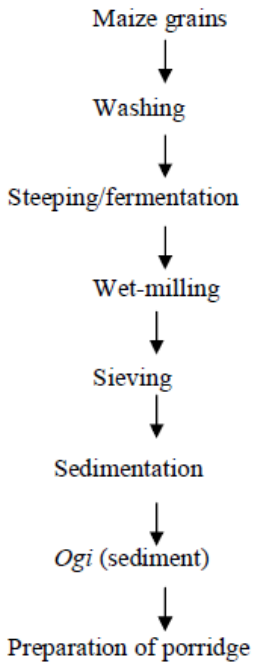

Figure 1: A flow diagram of the traditional method of corn paste (*Ogi*) production (Umo and Fields (1981).

Steps in traditional processing of Corn paste (*Ogi*)

1. Maize grains are washed thoroughly to remove dust particles and the impurities.
2. The grains are then steeped in earthenware, plastic, or enamel pots for 1-3 days at room temperature. (Microbial fermentation takes place during the steeping)
3. An electrically powered grinder is used to wet-mill the softened grains.
4. Water is then added to the ground material to obtain slurry.
5. The slurry is sieved by means of a finely porous cloth in order to remove parts of the hull.

6. The filtrate which is almost pure starch is allowed to stand for 20-30mins for sedimentation to take place.
7. The starch paste which is obtained can be prepared into corn paste (*Ogi*) porridge by introducing small quantity of hot water.

Although, the figure above demonstrates the standard traditional methods of corn paste (*Ogi*) preparation, there are notable variations in some communities which could affect nutritional composition and even hygiene of the food products. The subtle differences could make a difference in nutritive and sensory qualities of the traditionally processed wet corn paste (*Ogi*) (Oke, 2001). This is the basis for evaluating the traditional methods of preparing wet corn paste (*Ogi*) in the study area for comparison with the standard and implications on nutritional composition and sensory qualities of the product.

Microbial corn paste (*Ogi*) and nutritional studies by Akinrele (2002) showed that the lactic acid bacterium Lactobacillus plantarum, the aerobic bacteria Corynebacterium and Aerobacter, the yeasts Candida Aspergillus and Penicilliun are the major organisms responsible for the fermentation and nutritional improvement of corn paste (*Ogi*). Adegoke (2004) reported that efforts are currently underway in Africa to modify the processing of Corn paste (*Ogi*) with a view to enhancing its nutritive value shelf-life and possible therapeutic qualities. A protein-enriched corn paste (*Ogi*) containing 10% soya flour was developed by the Federal Institute of Industrial Research (FIIRO), Oshodi, Lagos, Nigeria (Akinrele, 2006). In Nigeria, Olukoya , Adeojo and Omotunde (2011) reported the development of an corn paste (*Ogi*) product having therapeutic properties on the basis of its ability to control diarrhea among infants. This finding is of great relevance since corn paste (*Ogi*) is used as a popular weaning food for children in Nigeria .

Objectives of the study

The major objective of the study was to assess the effect of different storage condition on the Physio-chemical properties of wet Corn paste (*Ogi*). Specifically, the study determined

(i) the effects of different storage conditions on the physio-chemical and microbial quality of Corn paste (*Ogi*) and
(ii) (ii) the microbial quality of corn paste (*Ogi*) sample stored under the three different storage conditions.

Materials and Methods

Material: Maize was purchased from Igboora market in Ibarapa Central Local Government Area, Oyo State, Nigeria.

Processing Method: 5 kg of white maize grains were wet milled and wet sieved and the sediment Corn paste (*Ogi*) allowed to settle. The steps taken to do this is presented thus:

Step 1: White maize were sorted and washed with clean water

Step 2: White maize (5kg) were washed and soaked in excess water for 3 days at starter temperature of 350^0C.

Step 3: Water was decanted off the maize and rinsed thoroughly

Step 4: Maize grains were wet milled and sieved and the sediment allowed to settle.

Step 5: The water on the sediment were removed and the sediment was divided into 4 samples and preserved under different storage conditions.

Instrument used: The following instruments were used;

- Cellophane
- Covered plastic
- Refrigerator

Data collection: Corn paste was prepared from the samples (stated earlier) after 21 days and subjected to sensory evaluation by 10 member panel consisting of Home Economics. Their responses on the sensory qualities of the samples were recorded.

Chemical Analysis: At interval of seven days for duration of 21 days, corn paste (*Ogi*)) samples were analyzed for changes in pH and acidity using the Association of Analytical Chemist (AOAC) (1996) standard of analysis. Results obtained were later analysed using pair comparison test method adapted from Ihekoronye and Ngoddy (2009) and/or Analysis of Variance (ANOVA) statistical tool.

The storage conditions used in preserving the samples are enumerated below:

Sample A: Wet Corn paste (*Ogi*) kept in covered plastic and stored under ambient temperature

Sample B: Wet Corn paste (*Ogi*) kept in sealed cellophane and stored under ambient temperature

Sample C: Wet Corn paste (*Ogi*) kept in covered plastic and stored in a refrigerator

Sample D: Wet Corn paste (*Ogi*) kept in sealed cellophane and stored in refrigerator.

All samples were kept for 21 days and microbial counts done in 7 days intervals.

Data collected were analysed using pair comparison test method adapted from Ihekoronye and Ngoddy (2009). Test of significant difference ($p < 0.05$) among the samples were done using ANOVA (Analysis of Variance) statistical tool.

Determination of pH: This was carried out using the pH meter. The pH meter was standardized using a buffer solution o pH7 and pH4. After standardizing, the pH electrodes were rinsed thoroughly with distilled water. It was later dipped into each of the samples one after the other. The readings were then taken and recorded. This was repeated three times to ensure a constant reading.

Determination of Titrable Acidity: The titrable acidity were determined by pipetting 10ml of the sample into the conical flask and adding the drop of 0.1% Phenolphthalein indicator and titrating to an end point (pink) with 0.1m sodium hydroscide (NaoH).

Sensory Quality evaluation: The sensory qualities of the samples were analysed using a 9 point hedonic scale on degree of likeness of the samples in respect to colour, flavour/aroma, taste and overall. The responses were analyse with Analysis of Variance.

Findings of the Study

Result of an evaluation of the pH content of the samples (corn paste) under different storage conditions) is presented in Table 1. Evidence on Table 1 reveals that there was no significant difference in the pH content of the wet corn paste (*Ogi*) kept in covered plastic (A) and sealed cellophane (B) (kept within the same time period) stored under ambient temperature.

Table 1: Result of analysis of wet Corn paste (*Ogi*) under different storage conditions

Storage conditions parameters	Samples	Days in storage			
pH (%)		**0**	**7**	**14**	**21**
	A	5.90[a]	4.68[b]	3.75[c]	3.32[c]
	B	5.90[a]	4.53[b]	3.60[c]	3.25[c]
	C	5.90[a]	5.20[a]	4.53[b]	4.03[b]
	D	5.90[a]	5.15[a]	4.40[b]	4.00[b]
Acidity (%)	A	0.0675[a]	0.0698[a]	0.0705[b]	0.0712[b]
	B	0.0675[a]	0.0697[a]	0.0710[b]	0.0715[b]
	C	0.0675[a]	0.0685[a]	0.0688[a]	0.0685[a]
	D	0.0675[a]	0.0683[a]	0.0692[a]	0.0680[a]

Values with the same alphabetical letter along the same Column do not differ significantly by $p<0.05$ stored under different storage conditions.
Source: Field survey, 2012

With respect to sensory evaluation of corn paste (*ogi*) presented in Table 2, it is evident that significant difference existed in the colour wet corn paste stored in covered plastic and kept under ambient condition and those stored in refrigerator. The same difference was noticed in the taste, aroma/flavor and overall acceptability of the two samples.

Table 2: Sensory Evaluation of Corn paste (*Ogi*) Pap with different treatments

	SAMPLES			
Sensory quality	**A**	**B**	**C**	**D**
Colour	6.80[a]	6.31[a]	7.55[b]	8.31[c]
Taste	6.51[a]	6.13[a]	7.50[b]	8.19[c]
Aroma/flavour	6.55[a]	6.44[a]	7.84[b]	8.19[c]
Overall acceptability	6.40[a]	6.31[a]	8.20[c]	8.50[c]

Values with the same alphabetical letter along the same row do not differ significantly by $p<0.05$ stored under different storage conditions.
Source: Field Survey, 2012

The study result presented in Table 3 shows the corn paste (*Ogi*) sample stored in the refrigerator had reduced fungi, bacterial counts which indicated that the refrigeration temperature reduced or inhibits the fermentation processes of the Corn paste (*Ogi*) samples. A high bacterial count and fungal count was observed in samples A and B which were stored at ambient temperature where, it is believed that short storage condition is likely to increase the fermentative microorganisms thus leading to increased the microbial counts

Table 3: Microbial count of Corn paste (*Ogi*) Pap with different treatments

	SAMPLES			
Microbial Count	**A**	**B**	**C**	**D**
Bacterial count	3.2×10^5	4.0×10^6	2.0×10^5	1.5×10^6
Fungi count	2.0×10^3	2.5×10^4	1.0×10^3	1.2×10^4

Values with the same alphabetical letter along the same row do not differ significantly by $p<0.05$ stored under different storage conditions. Source: Field Survey, 2012

Discussion of Findings

It was found from the study that there was no significant difference in the pH content of the wet Corn paste (*Ogi*) kept in covered plastic (A) and sealed cellophane (B) (kept within the same time period) stored under ambient temperature. The pH content however significantly differ between Corn paste (*Ogi*) kept for 7 days and 14 days. In the same vein, results in evidence from the study shows that there was no significant difference ($p < 0.05$) in the pH content of wet Corn paste (*Ogi*) stored, within the same time period, in refrigeration irrespective of whether it was sealed in cellophane or covered in plastic. However, the pH content seemed to reduce with increase in storage period from 7 through 14 days under the same condition Although further reduction was noticeable in day 21, it was not significant ($p < 0.05$). The implication of this is that the pH content of wet corn paste (*Ogi*) is significantly influenced not only by temperature but also by duration of storage. A producer/maker of corn paste therefore needs to take into consideration both temperature and duration of storage to avoid sourness and hazardous bacterial infestation.

The study results show that no significant difference occurred ($p < 0.05$) in the Acidity of wet corn paste (*Ogi*) until the 14th day of treatment irrespective of the storage condition (either kept in refrigeration or in ambient temperature). Besides, further, but insignificant, reduction was noticed in day 21. Results from the study also indicate that acidity level of wet corn paste (*Ogi*) is a function of period of storage and storage condition within 7-14 days.

The bacterial counts were found to be much more in wet corn paste (*ogi*) kept in sealed cellophane and stored under ambient condition than any of the other samples. This implies that keeping corn paste (*ogi*) under ambient condition constitutes greater health hazards to consumers of the products and should be avoided as much as possible.

Significant difference ($p < 0.05$) was found in the level of acceptability of colour, taste and aroma of wet corn paste (*Ogi*) kept in sealed cellophane and kept under ambient temperature (B), wet corn paste (*Ogi*) kept in covered plastic (C) or sealed cellophane (D) and stored in refrigerator. Corn paste (*Ogi*) kept in sealed cellophane and stored in the refrigerator was the most accepted with respect to colour and taste. However, the sample kept in covered plastic and stored in the refrigerator was accepted with regards to flavour/taste probably due to lactic acid fermentation which resulted in the sourness of the corn paste (*Ogi*) sample. This implies that to maximize degree of likeness of corn paste (*ogi*) by consumers (most especially students), the corn paste *(Ogi)* should rather be kept in sealed cellophane and refrigerated.

Conclusions

From the research findings, it is concluded that corn paste (*Ogi*) kept in covered plastic and sealed cellophane stored under ambient temperature had pH content reduced significantly from 7 through 14 days. No significant difference was found to occur in the Acidity of wet corn paste (*Ogi*) until the 14th day of treatment irrespective of the storage condition (either kept in refrigeration or in ambient temperature). Corn paste (*Ogi*) sample

stored in the refrigerator had reduced fungi and bacteria counts when compared with samples stored in ambient condition which indicated that the refrigeration temperature reduced or inhibits the fermentation processes of the corn paste (*Ogi*) samples. Corn paste (*Ogi*) kept in sealed cellophane and stored in the refrigerator was found to be the most accepted with respect to overall acceptability. Conclusively, corn paste should rather be kept in sealed cellophane and refrigerated for better performance.

Recommendation

Based on the study conclusion, it recommended that wet corn paste (*Ogi*) be kept in sealed cellophane and refrigerated for better preservation, sensory qualities and consumption.

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