Shelf Stability and Enzyme Activity Studies of Ogi: A Corn Meal Fermented Product

* Ohenhen, R. E., ** Ikenebomeh, M. J.
* Department of Microbiology, Ambrose Alli University, Ekpoma, Nigeria
** Department of Microbiology, University of Benin, Benin City, Nigeria
* Corresponding author: drginaohen@yahoo.co.uk
drginaohen@yahoo.co.uk

Abstract: Ogi slurry was produced by fermenting corn grains with previous steep water for 72h in the ratio of 100:0 Steep water: water and the resulting ogi slurry was called inoculated fermented ogi slurry. Shelf life studies of inoculated fermented ogi slurry were carried out for 60 days. The pH, titratable acidity, colour and flavour were monitored and were observed not to have changed throughout the 60 days period of investigation. Enzyme activity was determined in the inoculated fermented ogi slurry and results showed that proteinase activity was higher in inoculated fermented ogi slurry ($6.05^{+}0.01$mg/ml) compared to the uninoculated ogi slurry ($4.08^{+}0.01$mg/ml). A similar trend was observed for amylase and lipase activities. [The Journal of American Science. 2007;3(1):38-42].

Keywords: corn; ferment; grain; ogi slurry

Introduction

Ogi is popular in Nigeria and in most of West Africa. It is an acid fermented cereal gruel or porridge made from maize (*Zea mays*) or corn; sorghum (*Sorghum vulgare*) also known as guinea corn or millet (*Pennisetum typhoideum*). The choice of grain depends on preference and ethnicity. The ogi porridges are very smooth in texture, perhaps similar to hot blanc mange and has a sour taste reminiscent of that of yoghurt (Banigo and Muller, 1972). The colour of ogi depends on the colour of the cereal used, cream for corn, reddish brown for sorghum and dirty grey for millet (Banigo, 1977; Onyekwere and Akinrele, 1977). The principal unit operations involved in ogi preparation include soaking, fermentation, grinding, sieving and boiling. The microorganisms in ogi have been isolated and identified (Ohenhen, 2002), molds associated with the surface microflora of fermenting corn are *Cephalosporium sp, Rhizopus sp, O'ospora sp, Cercospora sp, Fusarium sp* and *Aspergillus sp*, including *A. niger* and *Penicillium sp, Cephalosporium sp* predominates. All are eliminated within 6h of steeping. The bacteria are *Corynebacterium sp, Clostridium sp, Enterobacter cloacae* and *Lactobacillus plantarum, Lactobacillus brevis* and *Acetobacter sp*. Yeast isolated were *Saccharomyces cerevisiae, Rhodotorula sp* and *Candida mycoderma*. The above microorganisms are not all found in all fermentations. The predominant microorganism in the ogi fermentation is *L. plantarum* responsible for the production of lactic acid, the main acid (Banigo and Muller, 1972). According to Wilbald (1993), it is possible to prepare liquid cereal gruel from corn with a 30 to 35% flour concentration, with a fermentation technique using a natural lactic acid starter culture and addition of flour of germinated seeds. The energy density of such lactic acid fermented gruel is about 1.2kcal/g, as compared with 0.4kcal/g in a non fermented gruel prepared to the same consistency this represents a three fold increase in energy density.

Kapsalis (1987) defined shelf life as the length of time required for the average acceptance of a product and noted that the desired shelf life of a product may vary from a few days to several days or years. Kapsalis (1987) observed that different parameters such as P^{H} and titratable acidity may be used for this determination.

Ogi in the form currently available to the consumers cannot be stored at home for any length of time without spoilage. Therefore, there is a great need to extend the shelf life. Extended shelf life will help to keep it in good condition for a much longer time, as a weaning food and breakfast cereal and allow effective distribution to all consumers. The objective of this study is to study the shelf stability and the enzyme activity of the product – ogi.

Materials and Methods

Source of materials

Corn grains (*Zea mays*) were used for the study. Two varieties consisting of yellow and white grains were bought from oba market in Oredo Local Government Area, Edo State, Nigeria.

Sample preparation

Ogi slurry was prepared by weighing one kilogram each of the two varieties (yellow and white) of cleaned corn grains. These were steeped, each in 4 litres of previous steep water with an inoculum load of 2.60 x 10^{6} cfu/ml for 72h at $28^{+}2^{0}$C. The grains were wet

milled and wet sieved and the resulting ogi slurry analysed.

Shelf life Study

The shelf life of ogi sample, which were dried and kept in sealed polytene bags were monitored at two temperatures 4^0C and $28^{+}2^0$C for a period of 60 days using the parameters below

-P^H and Titratable acidity (TA)

The P^H and titratable acidity of the test samples were monitored at intervals of 5 days. The mean P^H and TA values of 3 determinations were noted for each sample.

-Colour

The colour of the test samples were observed on 5 day basis to detect any change (visual examination)

-Flavour

The test samples were assessed on 5 day basis to detect changes as well as note any objectionable taste.

Enzymology

-Preparation of crude enzyme extract.

The method described by Theerakukait and Barret (1995) was employed. Extraction of crude enzyme was by suspending 10g of ogi in 40ml cold 0.1m phosphate buffer (pH 7.0) and mashed in a mortar. Crude enzymes trapped in the cells were liberated by addition of a little amount of acid washed sand and thereafter filter through muslin cloth and Whatman No 1 filter paper. The filtrate was stored frozen until used.

-Determination of Amylase Activity

The amylase activity of samples was determined by reaction of 1ml of the enzyme extract with 1ml of 1% (w/v) starch solution and 2ml of phosphate buffer (P^H 6.9). Incubation was for 1h at 30^0C. The reaction was stopped by adding 3ml of DNSA (containing 3.5g dinitrosalicylic acid, 1ml 2m NAOH, 20ml potassium-sodium tartarate, distilled water to make 100ml). The mixture was boiled for 5 min in a water bath to stop the reaction and cooled, 10ml of distilled water was added and the optical density of the resultant solution was determined at 550nm with a SP 30UV spectrophotometer (Pye Unican, Cambridge). The amount of reducing sugar formed was read from the standard curve of increasing values (0.125-2.0mg/ml) of glucose. The results were reported as amylase units. One unit of the enzyme activity is defined as the amount of enzyme that produces reducing sugar corresponding to 1mg of glucose from soluble starch in 1min under the assay conditions.

-Determination of Proteinases Activity

Proteinase activity was determined by adding 10ul of enzyme extract to 0.98ml of 0.02m phosphate buffer (P^H 7.0) and incubated at 30^0C for 5min after which proteinase assay was carried out. For the assay the modified method of Kunitz (1946) was used.

Proteinase activity was measured using casein digestion method. Casein solution (1%w/v) was prepared in 0.1m citrate-phosphate buffer (P^H 7.5), heat denatured at 100^0C for 15min in water bath, cooled and used as substrate. The reaction mixture consisted of 1ml of the substrate thoroughly mixed with 0.5ml of the enzyme preparation. Incubation was for 1h at $35^{+}2^0$C. Adding 3ml of cold (2^0C) 10% (trichloroacetic acid) TCA terminated the reaction. The tubes were allowed to stand for 1h at 2^0C to allow undigested protein to precipitate. The tubes were centrifuged at 15000 rpm at 4^0C for 30min. The supernatant fluid was analysed for unprecipitated protein by the method of Lowry *et al*, (1951). One unit of enzyme activity was defined as the micromole of non-precipitable tyrosine produced per 30min.

-Determination of Lipase Activity

Lipase activity was assessed by method of Ota *et al*. (1982) except that 0.1M phosphate buffer, P^H 8.0 was used instead of 0.2m Tris/maleate/ NaOH buffer. Olive oil was used as substrate and the fatty acids liberated over 50min incubation at $35^{+}2^0$C were determined by titration with 0.05M NaOH. One unit of lipase activity is defined as the amount of enzyme capable of releasing 1ml of oleic acid in 1min under the condition used.

Results

On Table 1 is shown proteinase, lipase and amylase activities for inoculated fermented ogi slurry (100 : 0 steep water : water) and uninoculated fermented ogi slurry. High proteinase activity was recorded for inoculated fermented ogi slurry compared to the uninoculated fermented ogi slurry, the same trend was observed for amylase and lipase activity.

Table 1: Enzyme activities (mg/ml) during production of white and yellow varieties of ogi slurry inoculated with steep water (100:0 steep water : water) and uninoculated ogi samples.

On Table 2 is presented the result of the shelf life study carried out on inoculated fermented ogi slurry. The pH , titratable acidity (TA), colour and flavour of the inoculated fermented ogi slurry and uninoculated fermented ogi slurry were monitored and compared throughout the 60days period of study. The uninoculated ogi slurry had a moldy flavour by 40 days of study. By the end of the 60days study, this was no longer edible in terms of colour and flavour. The colour had changed from white to cream and finally to brown, while the flavour from the characteristic sour to a

moldy flavour. On the other hand, the inoculated fermented ogi did not change in colour and flavour throughout the 60days of study.

Table 1. Enzyme activities (mg/ml) during production of white and yellow varieties of ogi slurry inoculated with steep water (100 : 0 steep water : water) and uninoculated ogi samples.

Enzymes	Inoculated fermented ogi slurry	Uninoculated fermented ogi slurry
Proteinase	$6.50^{+}0.01$	$4.80^{+}0.01$
Amylase	$4.43^{+}0.01$	$3.90^{+}0.01$
Lipase	$2.19^{+}0.01$	$1.38^{+}0.01$

Table 2. Shelf life study of inoculated fermented ogi slurry

Period of Analysis (Days)	Parameters determined	Inoculate fermented ogi slurry		Uninoculated fermented ogi slurry	
		$28^{+}2^{0}C$	$4^{0}C$	$28^{+}2^{0}C$	$4^{0}C$
5	P^{H}/TA	3.8/0.21	3.8/0.4	3.5/0.22	3.5/0.22
	Colour	white	white	white	white
	Flavour	Sour	Sour	Sour	Sour
10	P^{H}/TA	3.8/0.21	3.8/0.21	3.5/0.22	3.5/0.22
	Colour	White	White	White	White
	Flavour	Sour	Sour	Sour	Sour
15	P^{H}/TA	3.8/0.21	3.8/0.21	3.5/022	3.5/022
	Colour	White	White	White	White
	Flavour	Sour	Sour	Sour	Sour
20	P^{H}/TA	3.8/0.21	3.5/0.22	3.5/0.22	3.5/0.22
	Colour	White	White	White	White
	Flavour	Sour	Sour	Sour	Sour
25	P^{H}/TA	3.8/0.21	3.5/0.21	3.5/0.22	3.5/0.22
	Colour	White	White	White	White
	Flavour	Sour	Sour	Sour	Sour
30	P^{H}/TA	3.8/0.21	3.8/0.22	3.6/0.22	3.5/0.22
	Colour	White	White	White	White
	Flavour	Sour	Sour	Sour	Sour
35	P^{H}/TA	3.8/0.21	3.8/0.21	3.6/0.22	3.5/0.22
	Colour	White	White	Cream	White
	Flavour	Sour	Sour	Sour	Sour
40	P^{H}/TA	3.8/0.21	3.8/0.21	3.7/0.21	3.5/0.22
	Colour	White	White	Cream	White
	Flavour	Sour	Sour	Moldy	Sour
45	P^{H}/TA	3.8/0.21	3.8/0.21	3.7/0.21	3.5/0.22

	Colour	White	White	Cream		White
	Flavour	Sour	Sour	Moldy	Sour	
50	P^H/TA	3.8/0.21	3.8/0.21	3.8/0.21	3.6/0.22	
	Colour	White	White	White		White
	Flavour	Sour	Sour	Moldy	Sour	
55	P^H/TA	3.8/0.21	3.8/0.21	3.8/0.21	3.6/0.22	
	Colour	White	White	Brown		White
	Flavour	Sour	Sour	Moldy	Sour	
60	P^H/TA	3.8/0.21	3.8/0.21	3.8/0.21	3.6/0.22	
	Colour	White	White	Brown		White
	Flavour	Sour	Sour	Moldy	Sour	

Discussion and Conclusion

The results of this investigation have shown that the shelf life of inoculated fermented ogi was over 60 days, this indicates that the product can keep well beyond this period. However, the observation that the uninoculated fermented ogi had a shelf life of 40 days correlated with the observation of Akinrele (1970). Gould (1992) observed that metabolic products and the bacteriocins produced by lactic acid and related bacteria are antagonistic to the activity of other microorganisms in a product. The higher moisture content in the uninoculated fermented ogi was probably responsible for the early sign of spoilage observed during the study. Jay (1970) noted that one of man's oldest methods of preserving food is drying, which is a direct result of removal of moisture without which micro organisms can not grow.

The proteinase activity for inoculated fermented ogi slurry (100 : 0 steep water : water) had a higher proteinase activity, when compared with the uninoculated sample, this could be as a result of the proteolytic microorganisms present in the fermentation. An example of such organism is *Lactobacillus plantarum.* Lipase activity of the uninoculated sample was relatively low throughout the fermentation period compared to the inoculated fermented ogi slurry.

In order to achieve the desired abundant supply of indigenous foods and boost the country's needed economy, full industrial commercial production of local foods such as ogi is essential.

Correspondence to:
Ohenhen, R.E.
Department of Microbiology, Ambrose Alli University, Ekpoma, Nigeria
drginaohen@yahoo.co.uk
drginaohen@yahoo.co.uk

Received: January 15, 2007

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