MICROBIOLOGICAL QUALITY OF UNTREATED AND SALT-TREATED OGI (AKAMU) KEPT AT ROOM TEMPERATURE

MBAKWEM- ANIEBO C. AND UDEMGBA G.

Department of Microbiology, University of Port Harcourt, P.M.B. 5323, Port Harcourt Rivers State, Nigeria
chiakaniebo@yahoo.com

ABSTRACT: This study was designed to monitor the quality of treated and untreated Ogi kept at Room Temperature (28^{o}C) for three weeks. Treatment of Ogi was by the addition of different concentrations of cooking salt. Purchased Ogi was subjected to storage at ambient temperature. The first sample (Ogi 1) was kept without the replacement of the supernatant water throughout the experimental period, while the second sample (Ogi 2), had the supernatant water replaced daily throughout the experimental period. The samples were analyzed microbiologically. The analyses showed that Ogi 1 had higher total viable counts for both bacteria and fungi than Ogi 2. In Ogi 1, the bacterial counts ranged from 1.20 x 10^7 to 2.65 x 10^7cfu/g while in Ogi 2, the counts ranged from 1.25 x 10^7 to 1.65 x 10^7cfu/g. The fungal counts in Ogi 1 ranged from 3.5 x 10^6 to 1.35 x 10^7cfu/g, and 3.5 x 10^6 to 6.1 x 10^6cfu/g in Ogi 2. The bacteria identified were *Lactobacillus* sp, *Corynebacterium* sp, *Enterobacter* sp, *Citrobacter* sp, *Micrococcus* sp, *Staphylococcus* sp, while the fungi were *Aspergillus* sp, *Rhizopus* sp, *Fusarium* sp and *Saccharomyces* sp. The same bacterial and fungal genera found in Ogi 1 and Ogi 2 were identified in the salt-treated samples (Ogi 3 and Ogi 4) but there was a great decrease in the microbial load in samples with 0.005g/ml salt only *Bacillus* sp and *Staphylococcus* sp. were isolated. This work has shown that salt can serve as an inexpensive material for extending the shelf-life of Ogi.

[MBAKWEM- ANIEBO C. AND UDEMGBA G**. MICROBIOLOGICAL QUALITY OF UNTREATED AND SALT-TREATED OGI (AKAMU) KEPT AT ROOM TEMPERATURE.** Nat Sci 2012;10(8):26-29]. (ISSN: 1545-0740). http://www.sciencepub.net/nature. 5

Keywords: Ogi, (akamu), Fermentation, Supernatant, Cooking Salt, Preservation, Shelf-life.

1. INTRODUCTION

Ogi (akamu) is a product of fermented maize (*Zea mays*) widely eaten in Africa (Adams and Moss, 1995, Amakoromo, 2011). Similar maize preparations in Ghana are referred to as "Akana" or "Kenkey". Ogi is often marketed as a wet cake formerly wrapped in leaves but presently in transparent polythene bags. Gelatinized Ogi (a porridge) called "pap" is mainly used as a breakfast meal for adults and weaning food by low income earners who cannot afford the more expensive imported weaning foods.(Ozoh and Kuyanabana, 1995, Amakoromo, 2011).

In most parts of Africa especially in Nigeria, children are fed with mashed adult foods. These foods are bulky and this therefore reduces food intake by a child, often resulting in malnutrition. The development of nutritionally balanced calorie dense, low bulk and easily digestible weaning food becomes mandatory. This involves the use of simple but time consuming traditional technology called fermentation (Marero *et al*., 1989). The traditional fermentation method employed in Ogi production is a wild process and microorganisms are not controlled. Microbiological analyses have shown the presence of several genera of bacteria, moulds and yeasts in the fermented maize product-Ogi (Akinrele, 1970; Odunfa, 1985).

Ogi is fairly acidic (pH 4.8), which tends to inhibit the growth of some bacteria. Its spoilage however,is enhanced by some extrinsic factors amongst which is storage temperature. Extension of the shelf life of Ogi is carried out using various techniques, which include refrigeration, freezing and drying (dehydration) to reduce the microbial load and consequently spoilage(Amakoromo, 2011).

This study therefore, is aimed at finding an uncomplicated and inexpensive method of extending the shelf – life of Ogi (akamu).

2. MATERIALS AND METHODS

Ogi purchased from Rumuokoro market in Port Harcourt, wrapped in a clean polythene bag to avoid further contamination was taken to the laboratory within two hours. One hundred grams of the Ogi was aseptically put into each of two sterile conical flasks and 150ml of sterile distilled water was poured into each of the conical flasks. The two conical flasks (containing the samples) were kept at room temperature (28^{o}C) for three weeks. The supernatant of one of the samples (Ogi 1) was not changed throughout the experimental period, while the other sample, (Ogi 2) had the supernatant changed daily throughout the experimental period. One gram of each Ogi sample was added to 9.0ml

of sterile physiological saline in a test tube. Further ten-fold dilutions were made. Then from each dilution, 0.1ml was aseptically transferred to plates of Nutrient and Sabouraud agar in duplicates and spread using a sterile bent glass rod.

Three different salt concentrations (0.01g, 0.1g and 0.5g) were added separately to two sets of flasks containing Ogi. Each flask contained 50g of Ogi and 100ml of sterile distilled water. One set (Ogi 3) had its supernatant water unchanged throughout the experimental period as in Ogi 1. The second set (Ogi 4) had the supernatant water replaced daily as in Ogi 2. Flasks were also kept at room temperature for three weeks. The same procedure, as above was used to process these samples. Enumeration and identification of microorganisms were carried out according to standard procedures for the number of heterotrophic bacteria. Appropriate dilutions on Nutrient Agar (Oxoid), were used for Total Viable Count, on MacConkey Agar (Oxoid)for coliforms, on acidified Sabouraud Dextrose Agar for fungi For confirmation of the isolated bacterial organisms, typical colonies were identified using appropriate biochemical tests according to Bergey's Manual of Systematic Bacteriology (Krieg *et al*., (1994). The fungi were identified using the morphological and microscopic characteristics (Efiuvwevwere, 2002).

3. RESULTS

The present study carried out on the Ogi samples, showed that Ogi 1 had a higher total viable count for bacteria and fungi than Ogi 2. The bacterial count of Ogi 1 ranged from $1.20x10^7$ to 2.65×10^7cfu/g, and 1.25×10^7 to 1.65×10^7cfu/g for Ogi 2 (Table 1).

Table 1: Bacterial Load of Ogi Samples during storage

Storage Time (Days)	Total Viable Counts ($x10^7$ cfu/g)	
	Ogi 1	Ogi 2
0	1.20	1.20
3	2.20	1.40
6	2.40	1.50
9	2.45	1.50
12	2.55	1.60
15	2.65	1.65

The fungal count for Ogi 1, ranged from 3.5×10^6 to $1.35 \times 10^7$and 3.5×10^6 to 6.1×10^6 cfu/g for Ogi 2 (Table 2).

Table 2: Fungal Load of Ogi Samples during storage

Storage Time (Days)	Total Viable Counts (cfu/g)	
	Ogi 1	Ogi 2
0	3.5×10^6	3.5×10^6
3	1.10×10^7	3.8×10^6
6	1.15×10^7	4.2×10^6
9	1.20×10^7	4.3×10^6
12	1.30×10^7	5.1×10^6
15	1.35×10^7	6.1×10^6

Mean of duplicate experiments

The following bacteria *Lactobacillus* sp, *Enterobacter* sp, *Micrococcus* sp *Citrobacter* sp, *Staphyloccocus,*sp and *Bacillus* sp were identified (Table 3).

Table 3: Bacterial isolates (Ogi 1 and 2) after 15 days storage

Isolates	Bacteria
B_1	*Lactobacillus* sp
B_2	*Staphylococcus* sp
B_3	*Bacillus* sp
B_4	*Corynebacterium* sp
B_5	*Citrobacter* sp
B_6	*Micrococcus* sp
B_7	*Enterobacter* sp

Fungal species isolated and identified were *Aspergillus* sp, *Rhizopus* sp, *Fusarium* sp and *Saccharomyces* sp (Table 4). Majority of the fungi were seen to be *Saccharomyces* sp.

Table 4: Fungi isolates (Ogi 1and 2)

Isolate	Fungus
F_1	*Aspergillus* sp
F_2	*Saccharomyces* sp
F_3	*Fusarium* sp
F_4	*Rhizopus* sp

The same bacteria and fungi present in Ogi 1 and Ogi 2 were also identified in the salt - treated Ogi samples (Tables 3, 4, 7 & 8). But there was a great decrease in the microbial load especially with the samples containing 0.005g/ml salt where only *Bacillus* sp and *Staphylococcus* sp were isolated.

Table 5: Bacterial load of salt treated Ogi samples after 15 days storage

Type	Total Viable Counts cfu/g		
Ogi 3	$1.34x10^7$	$1.24x10^7$	$1.12x10^7$
Ogi 4	$8.9x10^6$	$7.4x10^6$	$3.5x10^6$

Table 6: Fungal load of salt treated Ogi samples after 15 days storage

Type	Total Viable Counts cfu/g		
Ogi 3	48 x10^6	3.5 x10^6	1.8 x10^6
Ogi 4	4.0 x10^6	2.5 x10^6	1.2 x10^6

Table 7: Bacteria isolates from salt-treated Ogi samples

Bacteria	NaCl Conc./ml					
	Ogi 3			Ogi 4		
	0.0001g	0.001g	0.005g	0.000	0.00	0.00
Bacillus sp	+	+	+	+	+	+
Staphylococcus sp	+	+	+	+	+	+
Lactobacillus sp	+	+	-	-	-	-
Micrococcus sp	+	+	-	+	+	-
Enterobacter sp	+	+	-	+	+	-
Citrobacter sp	+	+	-	+	+	-
Corynebacterium sp	+	+	-	+	+	-

Key: + = Present; - = Absent

Table 8: Fungi isolated from salt-treated Ogi samples during storage

Fungi	NaCl Conc./ml					
	Ogi 3			Ogi 4		
	0.0001g	0.001g	0.005g	0.000	0.00	0.00
Aspergillus sp	+	+	-	+	+	-
Rhizopus sp	+	+	-	+	+	-
Fusarium sp	+	+	-	+	+	-
Sccharomyces sp	+	+	+	+	+	+

Key: + = Present; - = Absent

4. DISCUSSIONS

The bacterial and fungal counts taken for both samples were found to be higher in Ogi 1 than in Ogi 2. The higher microbial load in Ogi 1 may be due to buildup of microorganisms in the water in which the Ogi was immersed and retained throughout the experimental period. Bacteria identified from Ogi samples were *Lactobacillus* sp, *Bacillus* sp, *Corynebacterium* sp, *Micrococcus* sp, *Staphylococcus* sp, *Citrobacter* sp and *Enterobacter* sp. *Lactobacillus* sp which was found to be the most dominant organism has been reported by several researchers as the most important and predominant microorganism involved in the fermentation of maize during Ogi production (Odunfa, 1985, Ozoh and Kuyanbana, 1995, Amusa *et al*., 2005). Other microorganisms essential in fermentation that were isolated were *Corynebacterium* sp and *Enterobacter* sp. This corroborates the report of Akinrele, (1970) that lactic acid bacteria *Lactobacillus* sp, *Corynebacterium* sp and *Enterobacter* sp were among the major organisms responsible for the fermentation and nutritional improvement of Ogi.

Bacillus sp, *Micrococcus* sp, *Staphylococcus* sp and *Citrobacter* sp which are of public health importance (Prescott *et al*., 2008), give an indication of possible contamination resulting from handling and processing environment as stated by Amusa *et al*., (2005).

The fungal counts were also higher in Ogi 1 than in Ogi 2 possibly due also to build up of microorganisms in the water in which the Ogi was immersed and retained throughout the storage period. Fungi identified were *Aspergillus* sp, *Fusarium* sp, *Rhizopus* sp and *Saccharomyces* sp. These microorganisms were also identified by Akinrele (1970) and Odunfa, (1985). *Aspergillus* sp, *Fusarium* sp and *Saccharomyces*, sp were also said to be responsible for the fermentation and nutritional improvement of Ogi. *Aspergillus* sp and *Rhizopus* sp produce organic acids, while *Saccharomyces* sp contributed to flavour development (Banigo and Muller, 1972).

In Ogi 3 and 4 treated with different salt concentrations (0.01g, 0.1g 0.5g), the bacterial and fungal counts were higher in Ogi 3 than Ogi 4. This could possibly be as a result of the reason stated above for Ogi 1 and Ogi 2. However, there was a great decrease in the bacterial and fungal counts in Ogi 3 and 4 containing 0.0001g, 0.001g and 0.005g salt in separate flasks. This could be as a result of the effect of salt on the non-salt loving organisms.

There was a significant difference in the microbial load of the two setups. The total heterotrophic counts were more in non salt-treated Ogi 1 and 2 than in salt-treated Ogi 3 and 4.

From the results obtained in this study, Ogi can be kept at Room Temperature and the supernatant water changed daily. The presence of most of the microorganisms did not really show that the Ogi was spoilt or of low quality, since most of the organisms present were organisms associated with its production. It is undesirable, however, to have foods with high microbial load. The use of 0.5g/l cooking salt in preserving Ogi should be encouraged, since it reduced the number and type of bacteria and fungi found in the product thereby extending its shelf-life. This level or amount of salt addition is so minimal and will not have any adverse health implications.

Correspondence to:
Dr. Chiaka Mbakwem-Aniebo
Department of Microbiology,
University of Port Harcourt, Choba,
PMB 5323 Port Harcourt, Rivers State, Nigeria;

E-mail: chiakaniebo@yahoo.com
Tel.: +234 803 675 3329

REFERENCES

1. Achi, O.K. (2005). The potential of upgrading traditional fermented food through biotechnology. Afri. *J. Biotech*. 4(5): 375-380.
2. Adams, M.R. and Moss, M.O. (1995).*Food Microbiology*. 3rd ed. Athenaeum Gateshead, Tyne and Wear, London. Pp 227-239.
3. Akingbala, J. O., Rooney, L. W. and Faubio, I. K. (1981).A Laboratory procedure for the preparation of Ogi-a Nigerian fermented food.*J. Food Sci*. 46: 1523 – 1526.
4. Akinrele, I. A. (1970).Fermentation studies on maize during the preparation of a traditional African Starch-cake food. *J. Sci. Food Agric.* 21: 619-625.
5. Amakoromo, E. R. (2011).*Indigenous FermentedFoods of Nigeria*: processing, composition and Improvement University of Port Harcourt Press, P. H, Nigeria. PP 57-65.
6. Amusa, N. A., Ashanye, O. A and Oladapo, M. O. (2005). Microbiological Quality of Ogi and soy-Ogi (a Nigerian fermented cereal porridge) widely consumed and notable weaning food in Southern Nigeria. *J. Food Agric. Environ*. 3(2): 81-83.
7. Banigo, E. I. O. and Muller, H. C. (1972). Manufacture of Ogi (a Nigerian fermented cereal porridge) comparative evaluation of corn, Sorghum and millet. *J. Food Sci. Tech*. 5: 217-221.
8. Barnet, H. L and Hunter, B. B. (1972).*Illustrated genera of imperfecti fungi*.3rd ed. Burgess, London. Pp 63-70.
9. Bressani, R. (1983). Effect of chemical changes during storage and processing on the nutritional quality of common beans. A review. *Food and Nutr*. Bull (UNU, S. O): 22-34.
10. Campbell-Plate, G. (1980). African locust bean (*Parkia*sp) and its West Africa fermented food product. Dawadawa. *Ecol. Food and Nutri*. 9:123-132.
11. Cheesbrough, M. (2000).*District Laboratory Practice in Tropical Countries*.2nd ed. Tropical Health Technology and Butterworth, London. 407pp.
12. Cruickshank, R., Duguid, J.P. and Swain, R.H.A. (1980).*Medical Microbiology*. 11thed. The English Language Book Society and E & S Living Stone Ltd, London. Pp 110-121.
13. Efiuvwevwere, B. J. O. (2002). *Agents of Tropical and Assorted Fruits and Vegetables*.1st ed. Jeson Services, Port Harcourt. Pp 10-42.
14. Ekpeyong, T. E. (1985). Biology education of improved local maize hybrids using rats.*Food Chemistry*. 6: 133-137.
15. Harringan, W.F. and McClane, M. E. (1976).Laboratory Methods in Foods and Diary Microbiology. Academic Press, London. 589pp.
16. Jay, J. M. (1996). *Modern Food Microbiology*.5th ed. Van Nostrand, New York. Pp. 334-336.
17. Krieg, N. R., Sneath, P.H.A., Stanley, J.T. and Williams, S. T. (1994). *Bergey's Manual of Determinative Bacteriology*.9th ed. Williams and Wilkins, Baltimore, 787 pp.
18. Marero, L.M., Pagumo, E. M., Aguinaldo, A. R. and Homma, S. (1989). Nutritional characteristics of weaning foods prepared from germinated cereals and legumes. *J. Food Sci*. 53 (8): 1399-1402.
19. Odunfa, S. A. (1985). African fermented foods. *In Microbiology of Fermented Foods*. (Wood, B. J. (ed.)). Elsevier Applied Science Publishers, New York. 25-42.
20. Olukoya, D. K., Ebigwei, S.I., Olasupo, N.A. and Ogunjimi, A.A. (2006).Genetics and Biotechnology Unit National Institute for Medical Research Edmond Cresent Yaba Lagos, Nigeria. *J. Tropical Paediatrics.* 40(2): 108-13.
21. Ozoh, P.T.E. and Kuyanbana, Z.U. (1995). Microbial quality of pap prepared from cereals sold in Bauchi markets, Nigeria. *Int. J. Environ. Health, Res*. 5:133-141.

5/28/2012