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Production and Isolation of Microorganisms in OGI: A Local Cereal Based Complementary Food in Nigeria

Okoronkwo Christopher Uche
Researcher, Department of Food Microbiology, Abia State University, Uturu, Nigeria
Dr. Okereke Hope C.
Senior Lecturer, Department of Microbiology, Abia State University, Uturu, Nigeria
Dr. Nwachukwu Ndubuisi Obiora
Lecturer, Department of Microbiology, Abia State University, Uturu, Nigeria

Abstract:
Maize was produced into Ogi by the fermentation. Bacteria isolated from the fermentation of maize substrate were Staphylococcusaureus,Streptococcus spp,Lactobacillusspp,Bacillus spp and Corynebacterium spp. The fungal isolates are molds, Penicillium spp, Fusarium spp, Aspergillus niger. The yeast isolated is Saccharomyces spp. Total bacterial counts in white maize ranged from 1.40 x 10^6cfu/ml to 4.20 x 10^5 cfu/mlwhile that of yellow maize ranged from 1.60 x 10^6cfu/ml to 4.60 x 10^6cfu/ml. There was no significant difference in bacterial isolates at p = 0.05. Therefore, there are significant difference in pH and temperature between white and yellow maize at varied time interval (P< 0.05).

Keywords: *Ogi, Maize, Fermentation, Bacteria, Fungi etc.*

1. Introduction

Fermentation is the process of anaerobic or partially aerobic oxidation of carbohydrate. In fermentation, enzymes produced by microorganism's breakdown carbohydrates or carbohydrate like material into simpler substances with a less subject to undesirable microbe's activity than the original material (Okaka and Okaka, 2001). Fermentation is a method of food preservation where the activities and growth of certain desirable microorganisms are encouraged. Optimum conditions of temperature, hydrogen ion concentration (pH), oxygen supply, nutrients, and water activity are maintained in order to promote the durable activities of the selected bacteria. The major chemical component of maize kernel is starch, which provides up to 72-75% of the kernel weight. Other carbohydrates in maize are simple sugars present as glucose, sucrose and fructose.

The starch in maize is made up of two glucose polymer – amylase and amylopectin. Protein is the next largest chemical component of the maize kernel. The protein content varies in common varieties about 8-11% of the kernel weights, most of which is found in the endosperm. The seed coat is characterized by a high crude fibre content of about 87% which is constituted mainly of hemicelluloses (37%), cellulose (23%). The endosperm is constituted mainly of 87.6% protein and mineral (FAO, 1992).

The fermentation of cereal based foods aims to achieve the following;

1. Affect the sensory properties of the food
2. Preservation which relies mainly on acidification and alcohol production.
3. Enhancing food safety by the inhibition of pathogens
4. Improving the nutritive value by removing antinutritive compounds
5. Removal of undesired compounds such as toxins, endogenous toxins, cyanogenic compounds etc.
6. Reducing energy required for cooking (FAO, 2005). Work is available on the fermentation of maize to Ogi. Little or no work is available on the bacterial succession and physicochemical changes during maize fermentation to Ogi. This has necessitated the study.

2. Materials and Methods

2.1. Sample Collection

White and yellow maize varieties were purchasedat Eke-Okigwe market, in Imo State. The samples were properly screened of defective grains which were discarded and prepared locally.

2.2. Maize Fermentation

The traditional techniques described by Banigo and Muller (1972) for ogi production was used in the fermentation of maize. 10kg of cleaned whole maize grains were steeped in tap water in plastic buckets. The buckets were covered with aluminum foil and the content allowed to ferment at room temperature of 29^0C for 48 hours. The steeping water was decanted and the fermented cereal ground to smooth slurry in local attrition mill. The slurries were sieved through a muslin cloth with excess water. The bran was discarded and the slurries allowed to settle for 3 hours. The water was decanted and sediment were dried at 55^0C for 12hours. The dried sample were passed through the local mill and sieved with 150-micron sieve and ready for analysis.

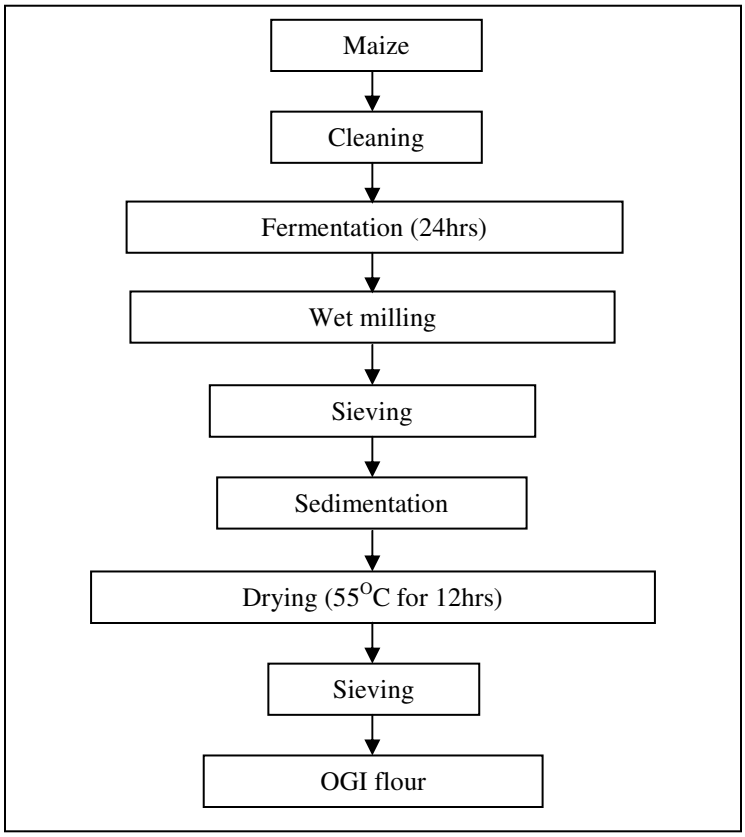

Figure 1: Flow Chart for the Preparation of Fermented OGI Flour

2.3. Isolation and Enumeration of Microorganisms from Fermenting Grain

Samples of the fermenting media were aseptically taken at 12 hours' interval of 3days. Bacterial and fungal isolation were carried out on Nutrient Agar and sabour and dextrose Agar respectively as adopted by Achi, (1992).

2.4. Identification of Microbial Isolates

The isolates were randomly selected and subjected to further analysis. Identification and classification of bacterial isolates were done as outlined by Cowan and Steel (1985). A close examination of the resulting colonies growing on the solid agar plates was done with consideration to the colony shape, size, elevation, consistency and optical characteristics. Biochemical examination was tested as outlined by (Cheesbrough, 2000)

Fermentation time (hrs)	White maize	Yellow maize
0	$2.10x10^2$	$2.20x10^2$
12	$2.60x10^3$	$2.70x10^3$
24	$2.61x10^6$	$3.80x10^6$
36	$3.30x10^6$	$3.90x10^6$
48	$4.20x10^5$	$4.10x10$
60	$2.00x10^6$	$4.60x10^6$
72	$3.00x10^7$	$2.40x10^7$
84	$1.40x10^6$	$1.60x10^6$

Table 1: Total Bacterial Count on Nutrient Agar during the Fermentation of Maize Varieties (CFU/ML)

P value=0.837> 0.05

Values are in average of triplicate.

Fermentation time (hrs)	White maize	Yellow maize
0	$1.30x10^1$	$1.20x10^1$
12	$2.10x10^2$	$1.40x10^2$
24	$2.90x10^3$	$2.90x10^3$
36	$3.40x10^5$	$3.80x10^5$
48	$4.50x10^6$	$2.00x10^6$
60	$2.00x10^6$	$2.10x10^6$
72	$4.20x10^6$	$4.30x10^6$
84	$6.40x10^6$	$6.60x10^6$

Table 2: Total Lactobacillus Count (TLC) During the Fermentation of Maize Varieties (CFU/ML)
P value=0.377>0.05, values are average of triplicate samples

Fermentation time (hrs)	White maize	Yellow maize
0	$1.40x10^1$	$1.20x10^1$
12	$2.50x10^3$	$2.15x10^3$
24	$3.10x10^3$	$3.20x10^3$
36	$2.50x10^5$	$2.40x10^5$
48	$3.80x10^5$	$3.70x10^5$
60	$2.30x10^6$	$2.00x10^6$
72	$2.70x10^6$	$2.15x10^6$
84	$2.80x10^6$	$2.60x10^6$

Table 3: Total Fungal Count (TFC) during the Fermentation of Maize Varieties (CFU/ML)
Values are average of triplicate samples, P=0.105> 0.05

Isolate	0	24	48	72	84	(hours)
Staphylococcus aureus	+	—	—	—	—	
Lactobacillus spp	+	+	+	+	+	
Bacillus spp	+	+	—	—	—	
Corynebaterium spp	+	+	—	—	—	

Table 4: Bacterial Occurrence during the Fermentation of White Maize

Isolate	0	24	48	72	84	(hours)
Staphylococcus aureus	+	—	—	—	—	
Lactobacillus spp	+	+	+	+	+	
Bacillus spp	+	+	—	—	—	
Corynebaterium spp	+	+	—	—	—	

Table 5: Bacterial Occurance during the Fermentation of Yellow Maize

→ Key + = Positive
→ — = Negative

Isolate	0	24	48	72	84	(hours)
Aspergillus spp	+	+	—	—	—	
Penicilliumspp	+	—	—	—	—	
Fusarium spp	+	—	—	—	—	
Saccharomyces spp	+	+	+	+	+	

Table 6: Occurrence of Fungal Isolates during the Fermentation of White Maize.

Isolate	0	24	48	72	84	(hours)
Aspergillus spp	+	+	—	—	—	
Penicillium spp	+	—	—	—	—	
Fusarium spp	+	—	—	—	—	
Saccharomyces spp	+	+	+	+	+	

Table 7: Occurrence of Fungal Isolate during the Fermentation of Yellow Maize.

→ Key + = Positive
→ __ = Negative

Fermentation time (hours)	pH of White Maize	pH of Yellow Maize	Temperature of White Maize	Temperature of Yellow Maize
0	6.10	6.15	29.58	29.49
12	5.60	5.06	29.01	28.80
24	5.65	4.39	29.00	28.78
36	4.80	4.40	28.04	27.84
48	4.90	3.90	27.88	27.40
60	4.10	3.72	27.28	26.18
72	4.60	3.45	27.20	26.24
84	3.30	3.34	26.30	26.20

Table 8: Results of the Physico- Chemical Analysis of Fermented Maize Grain during the Production of OGI.

→ P value for pH = 0.015 <0.05
→ P value for Temperature = 0.020 <0.05

3. Discussion

This study shows that production of Ogi from maize is caused by microbial fermentation with *Lactobacillus spp* being the most dominant among the bacteria isolated. The presence of *Aspergillusniger* and *Penicillium spp*is an indication of contamination as they are common spoilage organism of carbohydrate containing foods (Onovo, 2006). The organisms responsible for the fermentation are mainly amylolytic constituents of the grains (Achi, 1990). Bacillus Spp have been associated with fermenting cereal of burukutu (Achi, 1990).*Lactobacillus spp, Streptococcus spp* and *Saccharomyces spp* were the predominate microorganism, they may be responsible for the taste of Ogi which is an equivalent of Yoghurt (Banigo and Miller, 1972).

Isolation of *Staphylococcus aureus* in the white and yellow maize at zero hour of fermentation could be as a result of contamination of the grain from handling in the market place.

Statistically, using a T-text analysis, table one shown no significant different between bacterial count in white and yellow maize ($p = 0.0837 > 0.05$). There was no significant difference between *lactobacillus* counts isolated from white maize and yellow maize in different time intervals ($P\ 0.377 > 0.05$).

Moreso, there are no significant difference between the fungal isolatesboth in white and yellow maize at varied time intervals($P = 0.105 > 0.05$).

There is a significant difference between the pH level of white and yellow maize at varied time intervals ($p = 0.015 < 0.05$), the same trend was observed in the temperature of white and yellow maize ($p = 0.020 < 0.05$).

4. Conclusion

Preparation of Ogi under unhygienic condition are frequently heavily contaminated with pathogens and may be a major factor in causing diarrhoeal disease and associated malnutrition on children (WHO,1998). The processing of Ogi should be done in a clean and ventilated environment to ascertain microbial free diet (Obasi, *et al.,* 2009)

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