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Influence of *Saccharomyces cerevisiae* (Baker's Yeast) on the Fermentation of Ogi-A Nigerian Fermented Food

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Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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ABSTRACT

Ogi is a traditional fermented food produced from maize and serves as breakfast food for the majority of the population and is a good food choice for the sicks. Locally produced Ogi varies in its quality and shelf life because it is produced without any starter culture. In order to standardize ogi production there is need to use appropriate starter culture for ogi production. In this work influence of processing method and the use of *Saccharomyces cerevisiae* (*S. cerevisiae*) on quality attributes of ogi samples was investigated. Maize samples soaked in water for two days were allowed to germinate. The sprouted and unsprouted maize samples were wet milled and then inoculated with yeast *S. cerevisiae*. The samples were then fermented, and physico-chemical and microbiological changes was determined during fermentation. There was significant drop in the final pH values of the four preparation from changes 5.65 down to 3.51. Mean while, respective titratable acidity (TTA) increased on average from 0.175 up to 0.220 g/L. The total viable count of yeasts increases from

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9.80 x 10^7 to 1.26 x 10^{14} cfu/mL. While, the fungal count increased within narrow ranges from 3.0 X 10^7 up to 3.2X10^{13} cfu/mL. The coliform counts were reduced steadily and completely disappeared after 48 hours of fermentation. The four ogi preparations were quite high in their moisture contents (7 0 - 76.5%). The crude protein contents fluctuated between 1.82 and 5.47% in the (4) ogi products. This work showed that ogi prepared from unsprouted maize grains and without yeast fermentation ranked highest with regard to highest protein content and sensory evaluation and received overall acceptability of 7.

Keywords: Maize; fermentation; Saccharomyces cerevisiae; ogi; indigenous food.

1. INTRODUCTION

Maize which is a member of grass family was introduced in to West Africa by the Portuguese in the 10th century. Maize has become an important crop in Nigeria based on the number of farmers that cultivate it and its economic value. Maize is being cultivated in various ecological zones such as rain forest and derived savanna [1]. Maize which stated as a subsistent crop is now being produced on a large scale and there are many agro allied industries which depend on it as raw material.

Maize is the third most important cereal in the world after rice and wheat and ranks fourth after millet and rice in Nigeria. Maize is a prolific plant therefore it grows across different ecological zones; and it is highly nutritious and easy to digest. It is a good source of carbohydrate and it also supply vitamins A and C if consume before it ripes. Maize grows well in tropical climates and now being produced by numerous countries with suitable climatic conditions [2].

Ogi is an indigenous semi solid food produced from maize, millet and sorghum [3]. It is a traditional breakfast for many people and it serves as weaning food for children and a choice food for the sick. Ogi is often marketed as a wet cake wrapped in leaves or transparent polythene bags. It is diluted to a solids content of 8 to 10% and boiled into a pap, or cooked and turned into a stiff gel called “agidi” or “eko” prior to consumption. This is usually eaten hot with beans ball (akara). It serves a popular breakfast food in Nigerian [1]. It is easily produced on village art because the grains are readily available cheaper compared to industrially prepared or produced infant meals [2].

The influences of sprouting or germination on nutrition quality of some grains and legumes have been reported. It has been shown that sprouting improved the net protein of chickpea. It has also been demonstrated that sprouting improved the vitamin content and amino acids in maize and sorghum. However, information on the effect of sprouting and fermentation on quality attributes of maize is scarcely reported.

Moreover, fermentation has been reported to improve the digestibility of some grain legumes and enable their nutrient content such as protein and mineral [4]. Fermentation of ogi is by microorganism from the environment and quality control is absent in the traditional method of preparation [5]. A lot of nutrient losses during processing of cereals for ogi manufacture hence, several attempts have been made to improve the nutritional status of ogi by fortifying it with protein rich substrate. Nutritional improvement of those fermented cereals gruels with protein foods lowered their pasting viscosities and sometimes affected their sensory attributes adversely. These factors are likely to influence consumer acceptability.

Therefore, the aims and objectives of this present work are to determine the effect of sprouting and fermentation on nutritional quality and acceptability of ogi produced from maize.

2. MATERIALS AND METHODS

2.1 Sample Collection and Preparation

The maize samples were purchased from a Bodija market in Ibadan metropolis. In the laboratory, the maize samples were divided into four equal portions and treated according to the following flow chart.

The maize samples were divided into two different parts. The first part was soaked in water for about 2 – 3 days. Thereafter, it was allowed to sprout, and later all the maize samples were soaked in water for 2 – 3 days. When they became soft they were wet milled with a commercial grinding machine which is locally fabricated in Nigeria. Later, the sprouted and unsprouted maize samples were divided into two equal parts, one sample from the sprouted and unsprouted maize slurry were inoculated

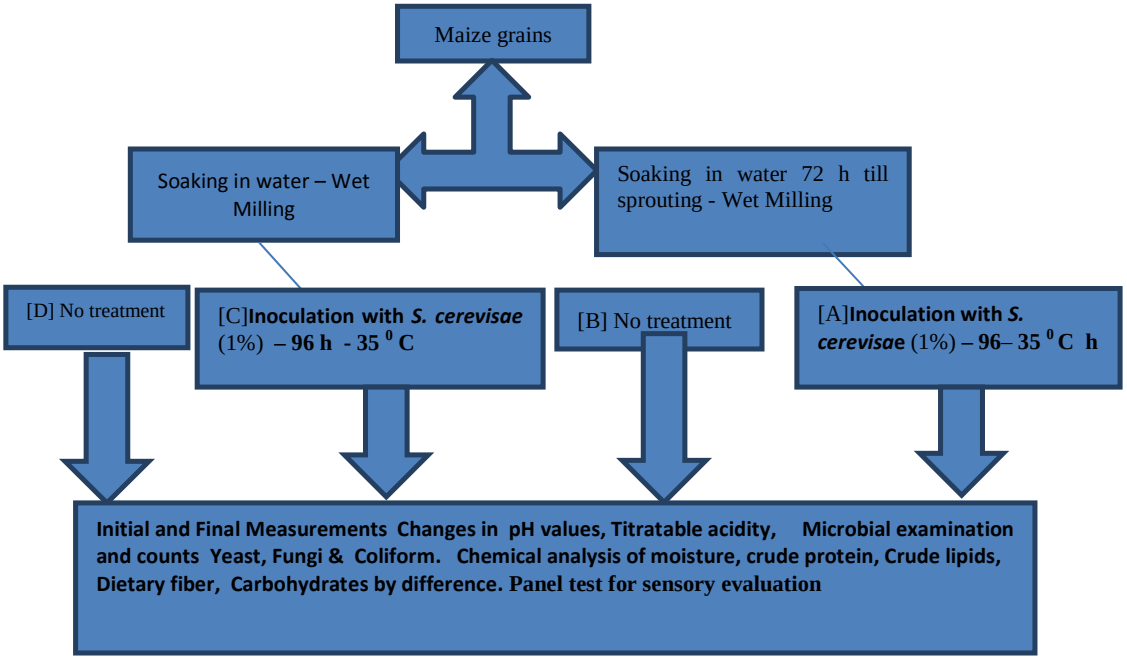

Fig. 1. Flow chart with the treatment of maize grains for the production of four different Ogi products

with *Saccharomyces cerevisiae* (baker's yeast), the samples were then fermented at ambient temperature of 30 – 35℃.

2.2 Fermentation of Samples

After wet milling, the ogi slurry was allowed to sediment and excess water decanted. Then, *Saccharomyces cerevisiae* (1%) was added and was kept at ambient temperature of 30 – 35℃ and the samples was checked after the period of 24 hours to monitor the physicochemical and microbiological changes of the ogi samples during fermentation.

2.3 Microbiological Examination - Preparation of Culture Media

The Nutrient agar (29 g/ Liter) was prepared according to the manufacturer instructions (LAB M). Potato dextrose agar (39 g /L) for fungi.

MacConkey Agar (48.5 g /Liter) for coliforms. The medias were autoclaved and then poured in Petri dish.

2.4 Microbiological Counts

One mL of the suspended Ogi was serially diluted in sterile distilled water, and appropriate dilutions were inoculated in the three above mentioned freshly prepared sterile medium. For bacteria ??? (or yeast??) The plates were incubated for 24 hours; for coliform, for 48 hours and for fungi for 72 hours.

The pH of ogi samples was determined using a standard pH meter. Ten mL aliquots before and after the 24 hour fermentation were distributed into 100 mL of beakers and the pH meter electrode was dipped into it for some seconds and the pH values were recorded.

2.5 Measurement of Total Titratable Acidity (TTA)

Total titratableacidity was determined in 20 mlsample aliquots of Ogi samples collected before and after the 24 hour of fermentation with *S. cerevisae* by titating with 0.1M NaOH using phenolphthalein as an indicator till the appearance of pink colout, which is equivalent to a pH of approximately 6.8. The volume of sodium hydroxide was multiplied by 0.09 to give the % of TTA as lactic acid [2].

2.6 Preparation of Ogisames for Chemical Investigations

Aliquots (200 g of well homogenized Ogi samples were samples before and after the 24 h

fermentation with *S. cerevisae* and dried in an air driven oven at 60℃. The dry ogi was ground electrically to finely ground flour and saved in air tight containers for subsequent chemical analysis.

2.7 Proximate Analysis

The contents of moisture, crude protein, fat, ash and crude fibre were determined using the AOAC [6] method. Carbohydrate content was calculated by difference.

2.8 Sensory Evaluation of Samples

The Four ogiproducts were cooked for ten minutes according to traditional cooking practices. Sensory evaluation was carried out on the cooked ogi products by a panel of ten judges, who were students of The Polytechnic, Ibadan and who were familiar with the traditional ogi.

Each ogi product was poured in 50 g aliquot in a plastic cup with cover and were labeled A, B, C and D. Evaluation was based on taste, texture, odour, colour, appearance and general acceptability. The evaluation was rated using 9 points Hedonic scale whereby one was extremely dislike and nine was extremely like.

2.9 Statistical Analysis

The data obtained were evaluated using Student't test and Duncan multiple range test [2].

3. RESULTS AND DISCUSSION

Fermentation of Ogi with *S. cerevisae* was associated with gradual decrease in the pH value and minimum pH values were reached at the end of the 96 h fermentation period. Similar results were also obtained with Ogi samples incubated for after 96 hours in the absence of S cerevisae (Table 1). The present findings are in agreement with previous work of [2], who reported pH range of 3.5 and 5.65 during ogi production.

As expected, there was inverse relation between the duration of fermentation and the liberation of lactic acid, which was expressed in terms of TTA, with initial mean value of 0.175 mg/L in at 0 hour fermentation and 0.220 mg/L in the same sample at 96 hours of fermentation (Table 2) The results obtained in this work favorably compared to the work of Wakil and Dauda [2].

The changes in total viable count of yeasts is presented in Table 3, and the results showed that there was increase in total viable count up to 48 hours of fermentation. The values ranged between 9.8 x 10^7 cfu/mL at 0 hour fermentation in sample A and 1.26 x 10^{14} cfu/mL at 48 hours fermentation in sample D.

3.1 Viable Count Refers Total Microbial Population under Study

The fungal count is presented in Table 4 and the results showed that there was gradual increase in the count. The results obtained ranged between 3.0 x 107 and 3.2 x 1013 cfu/mL. According to Ijabadeniyi [7] the fungal count

Table 1. pH values during the 96 hours following different processing of maize milled grains for ogi production

	Fermentation period (Hours)				
Samples	**0**	**24**	**48**	**72**	**96**
ASPR-S.cer	5.65	5.60	5.00	4.55	3.51
BSPR	5.65	5.62	5.45	4.50	3.55
CS.cer	5.65	5.61	5.35	4.53	3.52
D NO	5.65	5.55	5.48	4.52	3.51

Key: SPR=Sprouted; S. cer = S. cerevisiae; NO = NO treatments

Table 2. Titratable Acidity (TTA) during the 96 hours following different processing of maize milled grains for ogi production

	Fermentation period (Hours)				
Samples	**0**	**24**	**48**	**72**	**96**
*A	0.175	0.188	0.190	0.200	0.220
B	0.176	0.189	0.191	0.195	0.200
C	0.178	0.187	0.191	0.195	0.210
D	0.177	0.188	0.192	0.970	0.210

**Sample code is as presented in Table 1*

during fermentation of quality protein maize ranged between 1.0 x 103 and 3.6 x 104 cfu/mL.

The coliform count during fermentation of ogi samples is presented in Table 5. The results indicated that these organisms were detected at the initial stage but disappeared by 48 hours fermentation. The disappearance of these organisms might be due to the production of acid and other antimicrobial agents by fermentative organisms like yeasts and lactic acid bacteria.

The Proximate analysis of the ogipropducts is presented in Table 6. The moisture content detected was high and ranged between 70 to 76.54%. The crude protein content of ogi ranged between 1.82 to 5.47% and was highest among the ogi prepared from unsprouted and unfermented ground maize mills, and was lowest in ogi prepared either from sprouted or from S cerevisae fermented maize milled grains. The carbohydrate contents varies widely according to treatment; being lowest in the sprouted and fermented with *S. cerevisae* (8.65%) and highest in (20.3%) in the ogi prepared from untreated maize grains. The percentage crude fat and crude fibre were low and fluctuated within narrow ranges between the 4 ogi products. Adegbehingbe [8] reported that ogi products with moisture content between 11.6 and 11.65%, the crude protein content ranged between 5.9 and 10.3% and carbohydrate content between 76.7 and 70.1%. Another study reported moisture content ranging between 11 - 33% and protein content of 11.5% [9]. This discrepancy in the moisture, protein an carbohydrate contents of Ogi found in the present study and those reported earlier suggests differences in the processing techniques and the urgent need for standardization of processing and fermentation.

The results of organoleptic properties such as appearance, taste, colour, aroma, texture and overall acceptability are presented in Table 7. The Ogi product [D] with no treatment; i.e., no sprouting and no fermentation with yeast and which was richest in its crude protein content was scored with highest overall acceptability [7]. The overall acceptability reported by Adegbehingbe [8] was significantly lower than value reported in this present work. This could be as a result of beany taste of lima seeds used in fortification by this author.

Table 3. Total viable counts (cfu/ml) during the 96 hours following different processing of maize milled grains for ogi production

	Fermentation period (Hours)				
Samples	**0**	**24**	**48**	**72**	**96**
*A SP- SC	$9.80x10^{7}$	$1.75x10^{14}$	$1.20x10^{14}$	$9.5x10^{13}$	$5.5x10^{13}$
B SP	$9.82x10^{7}$	$1.76x10^{14}$	$1.25x10^{14}$	$9.51x10^{13}$	$5.6x10^{13}$
C SC	$9.85x10^{7}$	$1.74x10^{14}$	$1.20x10^{14}$	$9.52x10^{13}$	$5.52x10^{13}$
D	$9.81x10^{7}$	$1.78x10^{14}$	$1.26x10^{14}$	$9.55x10^{13}$	$5.51x10^{13}$

**Sample code is as presented in Table 1*

Table 4. Total fungal count (cfu/ml) during the 96 hours following different processing of maize milled grains for ogi production

	Fermentation period (Hours)				
Samples	**0**	**24**	**48**	**72**	**96**
*A	$3.0x10^{7}$	$1.2x10^{13}$	$1.50x10^{13}$	$2.7x10^{13}$	$3.1x10^{13}$
B	$3.1x10^{7}$	$1.1x10^{13}$	$1.4x10^{13}$	$2.65x10^{13}$	$3.0x10^{13}$
C	$3.2x10^{7}$	$1.2x10^{13}$	$1.52x10^{13}$	$2.69x10^{13}$	$3.2x10^{13}$
D	$3.15x10^{7}$	$1.3x10^{13}$	$1.50x10^{13}$	$2.68x10^{13}$	$3.1x10^{13}$

**Sample code is as presented in Table 1*

Table 5. Total coliform count (cfu/ml) during the 96 hours following different processing of maize milled grains for ogi production

	Fermentation period (Hours)				
Samples	**0**	**24**	**48**	**72**	**96**
*A	$5.8x10^{7}$	$1.0x10^{13}$	-	-	-
B	$5.9x10^{7}$	$1.1x10^{13}$	-	-	-
C	$5.7x10^{7}$	$1.2x10^{13}$	-	-	-
D	$5.9x10^{7}$	$1.15x10^{13}$	-	-	-

**Sample code is as presented in Table 1*

Table 6. Proximate analysis of four ogi products

Samples	% moisture content	% crude protein	% crude fat	% crude fibre	% Ash	% carbohydrate
*ASP- SC	69.99	2.17	1.69	0.13	0.17	8.65
B SP	72.43	1.82	1.47	0.16	0.16	24.10
C SC	72.31	2.03	1.44	0.11	0.16	24.05
D	76.54	5.47	1.18	0.10	0.17	20.27

SP= Sprouted maize grains, SC = Fermentation of maize with Saccharomyces cerevisael

Table 7. Sensory evaluation of four ogi products

Samples	Appearance	Taste	Texture	Colour	Aroma	Overall acceptability
A*	5^{a**}	6^{b}	5^{a}	5^{a}	6^{b}	6^{b}
B	6^{b}	5^{a}	6^{b}	5^{a}	4^{d}	5^{a}
C	5^{a}	6^{b}	6^{b}	6^{b}	7^{c}	6^{b}
D	6^{a}	7^{c}	7^{c}	7^{c}	6^{b}	7^{c}

**Sample code is as presented in Table 1.*

***The data with the same alphabets are not significantly different according to Duncan Multiple Range Test*

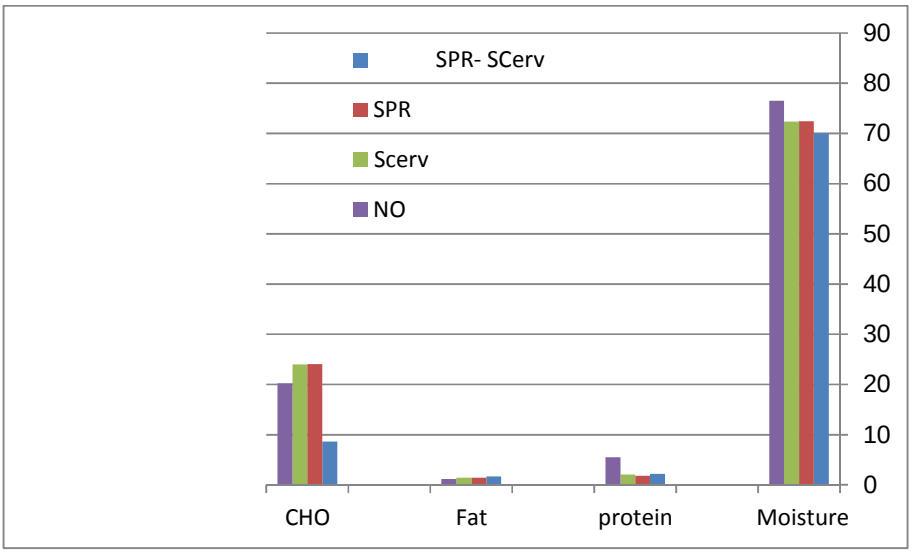

Fig. 2. Histogram illustrating the moisture, protein, fat and carbohydrate contents of four different Ogi products

4. CONCLUSION

The present results showed ogi prepared without sprouting or yeast fermentation had higher contents of crude protein compared with the other ogi products prepared by other pretreatments. Further studies are warranted to standardize the condition of processing for production ogi with well defined characteristics and to better understand the biochemical changes associated with processing and with safe microbiological properties.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Adegunwa MO, Alamu EO, Bakare HA, Godwin PO. Effects of fermentation length and varieties on the qualities of corn starch (ogi) production. American Journal of Food and Nutritions. 2011;4:166–170.

2. Wakil SM, Dauda A. Physilogical properties of a microbial community in spontaneous fermentation of maize (*Zea mays*) for ogi production. International Research Journal of Microbiology. 2011;2(3):109-115.
3. Banigo EOI, Muller HC. Carboxylic acid patterns in ogi fermentation. Journal of Science. Food and Agriculture. 1972;29(1): 101–111.
4. Wakil SM, Kareem MO. Quality assessment of weaning food produced from fermented cereal legumes blends using starters. International Food Resources Journal. 2012;19(4):1679–1685.
5. Onyekwere OO, Akinerele IA, Koleoso OAO. In K.H. Steinkrause (Ed.) Hand book of indigenous fermented foods. New York: Marcel Dekker. 1993;212-222.
6. AOAC. Offical methods of analysis (15th Edn). Association of Official Analytical Chemists. Washinton DC; 1990.
7. Ijabadeniyi AO. Microorganisms associated with ogi traditionally produced from three varieties of maize. Research Journal Microbiology. 2007;2:247–253.
8. Adegbehingbe KT. Microbiological analyses and nutrient composition of sorghum co-fermented with lima-bean seed. Research in Microbiology and Biotechnology. 2014;2(4):431–437.
9. Omemu AM, Bankole MO, Oyewole OB, Akintokun AK. Yeasts and moulds associated with ogi -A cereal based weaning food during storage. Research Journal of Microbiology. 2007;2:141–148.

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