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Chemical and Microbial Evaluation of 'Ogiri' (A Locally Fermented Food Condiment) Produced from Kersting Groundnut Seeds

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Abstract : *The total bacterial load in fermented Kersting groundnut seed (Macrotyloma geacarpum) was 2.70 x 10^{5} for 10^{-3}, 1.87 x 10^{-4}, 7.7 x 10^{-5} for 10^{-5} cfu/g; respectively. Six bacterial species were isolated from the fermented Kersting groundnut seed "Ogiri" which were tentatively identified to belong to the genera: Staphylococcus, Bacillus, and Escherichia coli, Treponemes, Salmonella and Lactobacillus. The proximate composition of ogiri from fermented Kersting groundnut seeds were crude protein 28.00%, Carbohydrate 19.00%, Ash 4.80%, Fat 10.00%, Crude fibre 4.00% and the moisture content of 34.20%. The results showed that ogiri from fermented Kersting groundnut seed had higher amount of crude protein and moisture content which are 28.00% and 34.20%; respectively. The mineral contents of ogiri from fermented kersting groundnut seeds were calcium 108.86mg/100g, potassium 27.93mg/100g, sodium 113mg/100g, iron 18.10mg/100g, phosphorous 37.90mg/100g. The calcium and sodium are the major trace elements with 108.68mg/100g and 113mg/100g respectively; others were available in minute concentrations. The result of the statistical analysis (ANAOVA) for the sensory evaluation results showed that in sample CCC, there was a significant difference (P<0.05) from other samples in terms of flavor. In taste, sample CCC (castor oil seed) and sample BBB (melon seed) had no significant difference. Then for colour, there was no significant difference (P>0.05) among the three samples. The ogiri from the fermented Kersting groundnut seed (AAA) was challenged with three pathogenic organisms: Staphylococcus, Escherichia coli, and bacillus. The results indicated a probiotic potential of freshly fermented "Ogiri" against some of the pathogens.*

Keywords: *Ogiri, Kersting Groundnut Seed, Bacterial Load, Fermentation, Proximate Composition*

INTRODUCTION

Background/ History of Ogiri

Ogiri is an oily food flavoring paste, produced from the fermented oil seeds such as egusi seeds, prosopis Africana (Mesquite seeds), castor oil seeds, fluted pumpkin seeds and sesame seed, and consumed within the West African countries (Odunfa, 1989).

It has a very strong aromatic smell that sets the whole house on a high pitch once the ogiri jumps into the soup pot. It is characteristically dark-brown in appearance. Different parts of Nigeria have different names for ogiri: for example, the Yorubas call it "Iru" while Hausa call it "Dawadawa".

The production process is still a traditional family art and the fermentation is by chance inoculated (Odunfa 1985). Ogiri serves as a cheap soup condiment particularly among the poor rural dwellers. In the South East Nigeria, ogiri can also be produced from castor oil seeds (Ricinus cummunis) (Enujiugha, 2003) and fluted pumpkin (Teliferia occidentale). Apart from Citrullus lanatus which is the regular substrate used for the production of ogiri, there are other varieties of melon seeds which are readily available in South-West Nigeria. These other melon seeds which are underutilized by fermentation processes can serve as alternative substrates for the production of "Ogiri".

Contamination of foods by pathogenic organisms remains one of the major public health problems worldwide. Food-borne diseases are endemic in many developing countries, and constitute a major cause of mortality in these areas.

Kersting's groundnut is a tropical crop, highly nutritious, adopted to drought-prone areas. The crop is neglected by both the researchers and policy makers. Kersting's groundnut seed also known as geocarpa groundnut contains 21% of crude protein, 6.2% of crude fibre, 61.53-73.3% carbohydrate and 3.0% of ash (Oyetaya and Ajayim, 2011).

The seed has a low fat content (1.0%) and low sodium (5.67mgg-1). This is particularly interesting in diet formulations for people suffering from high blood pressure, and those eager to lose weight. Kersting's groundnut seed can be equally used in production of locally fermented food condiment ("Ogiri").

Material and Methods

Source of Sample Collection

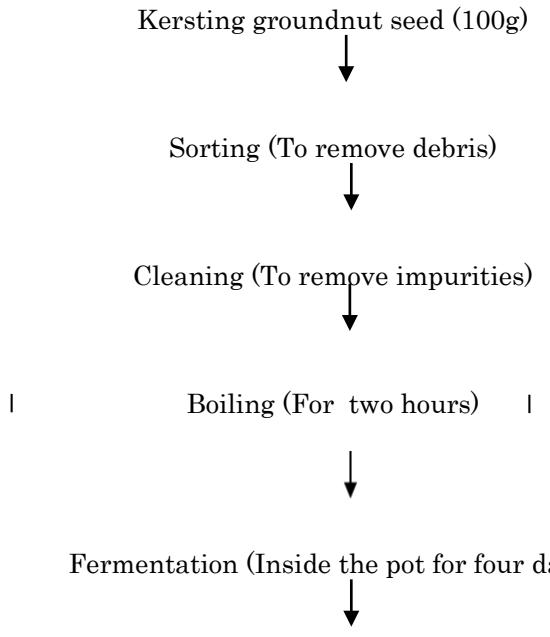
The raw materials used in this work (Kersting Groundnut) were purchased from Eke Oko Market, Orumba North Local Government Area, Anambra State of Nigeria.

Method and Preparation

100g of the sample Kersting groundnut seed was weighed on a weighing balance. The sample Kersting groundnut seed was soaked and washed. The seeds were dehulled and boiled with 1 liter of clean water for two hours. The Kersting groundnust seed was then allowed to ferment for four days.

The fermented kersting groundnut seed was pounded on the 4th day and placed in a tray. It was kept under the sun for 8 hours for drying. After drying, it was packaged in a non-toxic leave and allowed to mature for three days.

Production of "Ogiri"



Pounding (To reduce the size)

↓

Sundrying (place on a tray to dry under sun for eight hours)

↓

Packaging (packaged in a non-toxic leave)

Flow Chart for Processing of Kersting Groundnut Seed into "Ogiri"

Proximate Composition

The proximate composition of fermented Kersting groundnut seeds were analyzed by the method of Association of official Analytical Chemists (2005). Samples were analyzed for moisture content, fat, crude protein, ash content, crude fibre and carbohydrate.

Mineral Composition

Digestion of Sample

The mineral contents of the test samples were determined by the dry ash extraction method following on each specific mineral element as described by AOAC (2005). Twenty (20) g of the samples were burnt to ash on a muffle.

The ash was cooled and dissolved in 20ml 10% HNO_3. The solution was filtered through an acid washed filtered paper into a 100ml volumetric flask and made to volume with HNO_3 and well mixed where:

TV=Titrate value

0.4008 =Standard amount of calcium liberated by 0.01EDTA.

Microbiological Assessment

Agar Preparation

5.6g nutrient agar was suspended in 200ml of distilled water. Also 5.2g of Maconkey agar was suspended in 200ml of distilled water. It was boiled to dissolve completely and then poured into 250ml conical flask. It was covered with cotton wool and calcium fail and sterilized by autoclaving at 121^0C for 15mins. The bath was allowed to cool to about 45^0C (Balami, 2004).

Serial Dilution of Bacterial Enumeration

10g of the sample was weighed in a sterilized blender. 100ml of distilled water was added and blended for 15mins. 1ml was collected from the blended sample and transferred aseptically to the first dilution blank. The test tube was mixed thoroughly and the tube was labeled "10^{-1}". Using a fresh pipette, 1ml was transferred from the first blank to the second blank and mixed as before. The second bottle was labeled "10^{-2}". 1ml was transferred from the third bottle and labeled "10^{-3}". 1 ml was transferred from the third blank to the fourth blank using a fresh pipette and then mixed as before, the fourth blank was labelled "10^{-4}". 1 ml was transferred from the fourth blank to the fifth blank using a fresh pipette and was mixed as before. The fifth blank was labeled "10^{-5}". The petri dishes were labeled "10^{-3}" and "10^{-4}"; respectively. Liquid was transferred from the dilution blanks (10^{-3}, 10^{-4}) to the petri dishes using a separate pipette for each blank. Once at a time, about 15ml of nutrient agar was poured to each petri dish. The dishes were gently swindled for 30 seconds to mix the bacteria with the agar.

After the agar had thoroughly solidified, it was incubated at 37^0C for 48 hours. The numbers of colonies that had between 30 and 300 colonies were counted on a plate. Any plate which had more than 300 colonies were designated as Too Numerous to Count (TNTC).

Plates with fewer than 30 colonies do not have not enough individuals to be statistically acceptable. To compute the number of cfu/ml, the average of the colonies was found, multiplied the average by the dilution factors expressed in value in two decimal places. The result was recorded as cfu/ml.

Staining (Gram Staining)

The smear was covered with crystal violet and allowed to stand for 20 seconds. The stain was briefly washed off using a wash bottle of distilled water. Excess water was drained off. The smear was covered with grams iodine solution and allowed to stand for 1min. The grams iodine was poured off and the smear was flooded with 95% ethyl alcohol for 10-20 seconds.

Decolourization occurred when the solvent flowed colourlessly from the slide. The action of the alcohol was stopped by rinsing the slide with water from wash bottle for few seconds. The smear was covered with safranin for 20 seconds. It was gently washed for a few seconds blot with paper towel and allowed o dry at room temperature. The slide was examined under oil immersion immediately.

Sensory Evaluation

A semi-trained panel consisting of both genders,10 judges of different age groups having different eating habits was constituted to evaluate the quality. The students of Food Science were selected as the judges, the samples were served to the panelists and they were asked to rate the acceptability of the product through sense organ.

Results and Discussion

Result of Mineral, Proximate and Microbiological Properties of Ogiri from Fermented Kersting Groundnut Seeds.

Table 1 . Result of Mineral Composition of the Ogiri

S/n	Sample	Mineral element (mg/100g or ppm)				
		Ca	K	Na	Fe	P
1	Ogiri	108.86	27.93	113	18.10	37.90

Table 2 . Proximate Chemical Composition of Wet Weight of Kersting Groundnut Seed (gm/100gm)

S/n	Parameters	Sample (Ogiri) %
1	Crude protein	28.00
2	CHO	19.00
3	Ash	4.80
4	Fat	10.00
5	Crude fibre	4.00
6	Moisture content	34.20

Table 3. Microbiological Evaluation of Ogiri (Kersting Groundnut Seed)

Sample	Bacteria Isolated	Gram +	Gram -
Ogiri	Staphylococcus sp	√	
	Bacillus spp	√	√
	Escherichia coli		√
	spp		√
	Salmonella spp		√
	Lactotacillus spp	√	

	Fungi Isolated		
Ogiri	Fusarium	√	

Table 4. Sensory Evaluation of Ogiri from (Kersting Groundnut Seed)

Sample	Colour	Taste	Flavor	General Acceptability
AAA (Kersting Groundnut Seed)	7.40± 0.99[a]	6.30± 1.06[b]	6.41± 1.59[b]	6.73± 1.29[b]
BBB (Melon seed)	7.65± 0.58[a]	7.40± 0.70[a]	7.34± 0.72[ab]	7.24± 0.84[ab]
CCC (Castor oil seed)	7.95± 0.37[a]	7.30± 1.32[a]	7.70±1.03[a]	8.00± 0.62[a]

Discussion

Table 1 presents the mineral composition of ogiri from Kersting's groundnut seed. The ogiri prepared was rich in Ca (108.86mg/kg), K (27.93mg/kg), Na(113mg/kg), Fe (18.10mg/kg), P (37.90mg/kg) according to (Esenwah and Ikenebomeh, 2008), Ca (222.2mg/kg), K (1101.5mg/kg), Na (29.0mg/kg), Fe (9.3mg/kg), P (170mg/kg).

Table 2 present the proximate/ chemical composition of Ogiri from Kersting groundnut Seed (Wet weight). The amount of crude protein in Kersting groundnut seed was 28.00% which was higher that protein rich foods such as guinea (Ogungbenle et al., 2009), bambara groundnut, cowpea. The seeds ranged between 13.5-26.8% (dry weight). The high quality of protein can serve as a media for microorganisms, feed for animals and it can even serve as human food. The value obtained for carbohydrate (19.00%) in this work is rarely comparable with an acceptable range of values of legumes, 20-60% of dry weight. This result gave us indication that the energy source is relatively low. The ash content of Kersting groundnut seed which is an indicator for mineral elements in this work is 4.80% which is higher than ash values of 3.68%, 3.22% and 3.24% reported for pigeon pea, limabean and brebra seed; respectively (Aletor and Aladetimi, 1989). It has been recommended that ash content of seeds and tubers should be in the range 1.5-3.5% in order to be suitable for animal feed and also serve as microbial media without supplement.

The fat content of fermented seed of Kersting groundnut is 10% compared to that of the fermented seed of African locust bean and castor oil seed, which are 17.3% and 40.53%; respectively. This means that fermentation led to an increase in fat content. This shows that lipase activity is low in fermenting Kersting groundnut seed may be as a result of wet matter. The crude fibre of Kersting groundnut seed is 4.00% which is higher than 3.6% value reported for cowpea (Ojimelu, Onweluzo, 1999).

The moisture content of Kersting groundnut seed is 34.20% which is higher than the moisture content of fermented African locust bean and castor oil seed, which was 11.3% and 5.8% as a result of wet samples.

Table 3 presents the microbiological evaluation of Ogiri from Kersting groundnut seed. On the basis of morphological, cultural and biochemical characteristics, a total of seven microorganisms were identified including viz bacterial and one fungal isolate. The bacterial isolates were identified as Staphylococcus spp, Bacillus spp, Escherichia coli spp, Treponemes spp, Salmonella spp and lactobacillus spp as shown in Table 3, while the only fungi isolate is Fusarium spp. According to (Ibeabuchi et al., 2014), on microbiological evaluation of "Iru" and "Ogiri-isi', a total of eight microorganisms were identified including four bacterial and four fungal isolates. The bacterial isolates were identified as bacillus subtilis, Enterococcus faecalis, Staphylococcus aureus, Bacillus spp and Fungal isolates were identified as Sacharomyces cerevisiae, Penicillium spp, Rhizopus stolonifer and Saccharomyces cerevisiae var ellipsoideus.

In this work, Staphylococcus spp and bacillus spp were the similar bacteria isolated, while in fungal isolates, none was similar. From this point of view, the only fungal isolates may be as a result of the species of the legume family used (Kersting groundnut seed).

However, most researchers had also reported Bacillus and Staphylococcus sp as the predominant bacterial involved in fermentation. The total plate count of fermented Kersting groundnut seed (ogiri) on nutrient agar

was 2.70 x 10^5 for 10^{-3} dilution. At 10^{-3}, the microbial load was higher than the other dilution, and there is a decrease from 10^{-3} to 10^{-5}. From the health point of view, the presence and isolation of pathogenic organisms such as staphylococcus aureus, enteronoccus feacalis and some bacillus spp such as Bacillus cereus indicated poor hygiene practices during production and have the potential to produce diarrheal toxin (Collins, 1976).
Although fermented Kersting groundnut seed (Ogiri) has not been implicated in any form of mycotoxicity unlike fermented foods of South East that were fermented mainly by moulds. A practice of consuming ogiri that has not been subjected to best treatment should be discharged.
Table 4 presents the sensory evaluation of Ogiri from the Kersting groundnut seed. In colour, all the samples have no significant differences as shown in table 4.4. In taste, sample BBBss and sample CCC have no significant differences. In flavor, all the samples have significant differences. In general acceptability, all the samples have significant differences. The overall acceptability of samples prepared with Kersting groundnut seed was rated on the basis of a point hedonic scale ranging from 1 (extremely dislike) to 9 (extremely like). The data obtained from the various respondents were recorded during the study and were subjected to statistical analysis as per method of "Analysis of Variance" by factorial Randomized Block Design. The significant differences between the means were tested against the critical difference at 5% level of significant.

Conclusion and Recommendations

Conclusion

This work revealed that Bacillus spp and Lactobacillus spp were the predominant microorganisms involved in the fermentation of Kersting groundnut seed "Ogiri" as food condiments. The work has also indicated the possibility of up-grading Kertsing groundnut seed "Ogiri" production to cottage industry by using the predominant microorganism as a starter culture and also, by standardizing the processing conditions for the fermentation i.e. duration and temperature during fermentation of the substrate.
However, the ease of production is more with castor oil seed (Ricimus camminus) that the Kersting groundnut (Macrolyloma geocarpum) which is commonly available as the castor oil seed. More so, the dehulling of Kersting groundnut is difficult and needs to be mechanized.

Recommendations

Based on the findings, the following recommendations were made:

1. The seeds of Kersting groundnut are high nutritious, rich in amino acid and show interesting features to incorporate in infant food formulation and other industrial products.
2. Increasing the production of Kersting groundnut seed is likely to contribute to food security and constitutes an option to improve the resilience of rural population to drought.
3. The researcher further recommends that more research should be conducted on "Ogiri" produced from Kersting groundnut seed in order to help the consumers to make an appropriate choice of food intake.

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