Effect of Leaf-Type on the Nutritive and Organoleptic Properties of *Ogiri-Egusi* (Fermented *Citrullus vulgaris*) Seeds

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ABSTRACT---- ***The effect of wrapping type on the nutritive and organoleptic properties of Ogiri-egusi (fermented Citrullus vulgaris) seeds was studied. The leaves used were miracle fruit leaves (Thaumatococcus danellii), cocoyam leaves (Colocasia spp), and banana leaves (Musa sapientum). The melon seeds were hulled, sorted and washed, boiled for 4h, ground and then wrapped in small portions in different leaf-types and fermented for five days. Proximate analysis and sensory evaluation were carried out on the fermented products (Ogiri-egusi). Statistical analysis was also carried out on the sensory data at 95% confidence level (P>0.05). Results showed that the proximate composition of the Ogiri-egusi samples were not significantly (P<0.05) affected by the wrapping type. Samples wrapped in banana leaves were rated as the highest in moisture content, crude protein, crude fiber and fat with scores 29.17, 15.75, 14.00 and 9.83, respectively except in ash (3.67) and carbohydrates (64.01) while that of sensory evaluation showed that banana leaves were rated the highest in colour, aroma and texture with mean scores, 5.70 (slightly liked), 5.40 (neither liked nor disliked) and 5.10 (neither liked nor disliked) respectively, Miracle Fruit Leaves had the highest score in taste with mean score 7.90 (liked very much) and Cocoyam leaves had the highest in overall acceptability with mean score 5.50 (slightly liked) . From the proximate and sensory data, Banana leaves are advocated to be the best wrapping type for Ogiri-egusi production.***

Keywords--- Leaf-type, Nutritive, Organoleptic, Ogiri-egusi, Wrapping

1. INTRODUCTION

The use of new food packaging materials like polypropylene, polystyrene, aluminum foil did not discard the use of leaves as it is still being used as a packaging material in many parts of the world particularly in West Africa. Although, alternative food packaging materials are available, the leaves, of different types, are still being used to package ready-to-eat products such as *Fante Kenkey* (a corn-meal product packaged in dried leaves of either *Musa paradisiaca* or *Stercillia tragacanta*) (Mensah *et al.*, 2012). Reasons producers gave for continued use of leaves as packaging material includes medicinal via infusion of the product with beneficial phytonutrients that also imparts distinctive aroma and taste, environmental friendliness, availability, relatively low cost, lack of toxicity and renewability (Mensah *et al.*, 2012). Leaves such as *Thaumatococcus daniellii* (common name: Miracle Fruit) leaves, banana *(Musa sapientus)* leaves, plantain *(Musa* paradisiaca) leaves, cocoyam *(Colocasia esculentum)* leaves, *Thespesiapopulnea* (Malvaceae family), *Marantoclea spp* (Marantaceae family), sheaths of maize *(Zea mays)* are being used as packaging materials for ready-to-be consumed foods. All these in one way or the other contributes maximally to the quality of the product in taste and aroma.

The use of leaves as a food wrapper is no more restricted to the local populace resident in the villages and suburbs; it has gained wide spread acceptance, not only in the towns and cities of southwestern Nigeria, but also in some parts of the United States and the South Americas, where it is now acceptable and hip to display, buy and eat foods packed in such, even among the elites who consider the packaging (wrapping) as not only exotic, but also flavour enhancing.

The demerit of these leaves usage is that it does not promise prolonging the shelf-life of the food it contains as improper wrapping by producers could lead to microbial contamination (Kabuo *et al*., 2013). *Ogiri-egusi* fermentation is

still carried out using the traditional methods. This involves boiling melon seeds, cooling, wrapping in leaves and fermenting of prevailing temperature and relative humidity. The number and layer of leaves used in wrapping before fermentation vary depending on the individual carrying out the fermentation (Ogueke *et al.*, 2012).

Fermented foods, whether from plant or animal, plays an important role in the diet of people in many parts of the word. Fermented foods not only provide important sources of nutrients but have also great potential in maintaining health and preventing disease (Kabak and Dobson, 2011). It also improves the taste of an otherwise bland food, enhances the digestibility of a food that is difficult to accumulate, for example, castor plant *(Ricinus communis)*, preserve food from degradation by noxious organism, and increase nutritional value through synthesis of essential amino-acids and vitamins for example, in fermentation of maize *(Zea mays)* to *'Ogi'* (Yoruba) or *'Akamu'* (Igbo).

In Africa, the art of fermentation is widespread including the processing of fruits another carbohydrate sources to yield alcoholic and non-alcoholic beers and other fermented cereal product which provide instant energy in breakfast and convalescent diets (Omafuvbe *et al*., 2004). *"Ogiri-egusi"* which is an indigenous fermented soup condiment is used as flavouring agent whose character and organoleptic properties depend on microbial activities (Ogueke *et al.*, 2012).

Consumed mainly in southern Nigeria especially by the Igbos, it is produced by traditional methods of uncontrolled solid substrate fermentation of melon seeds *(Citrullus vulgaris)* (Ogueke *et al*, 2012). *Ogiri-egusi* is known to influence the caloric and protein intake and is generally added to soups as low-cost meat substitute by low-income families in parts of Nigeria (Ogueke *et al.*, 2012). As a result to it being needed in many homes, variations occur which causes differences in quality (which is the need for this study as standardization of the type and number of leaves used wrapping this product is important to improve its organoleptic properties and nutritive value).

The study therefore, is out to evaluate the proximate composition of the products wrapped in different wrapping materials (leaves), the effect of different wrapping materials on the organoleptic of *Ogiri-egusi* and to identify the best wrapping materials that would give the best and most acceptable organoleptic properties.

2. MATERIALS AND METHODS

The materials used included melon seed *(Citrullis vulgaris)* which was sourced from a local market in Owerri metropolis, Imo State, Nigeria. The banana and cocoyam leaves used for wrapping were collected within the environment of Federal University of Technology, Owerri (FUTO), while the Miraculous Fruit Leaves were obtained from Ngor-Okpalla Local Government Area of Imo state. The equipment and instruments and chemical were obtained from the Laboratory of Food Science and Technology Department, and the work was carried out in the same laboratory.

Identification of the ieaf-types: The miraculous fruit leaves *(Thaumatococcus daniellii)* (known as *'Uma'* in Ibo) was sourced from Ngor-okpala LGA in Imo State, Nigeria and identified by a professor in Crop Science and Technology, Federal University of Technology, Owerri.

2.1 Preliminary preparation of the wrapping materials

The wrapping materials such as Miraculous Fruit Leaves *(Thaumatococcus daniellii)*, banana leaves *(Musa sapientum)* and cocoyam leaves *(Colocasia esculentum)* were washed and drained. The banana leaves were then blanched over the flame in order to make them flexible and to resist tearing.

Cleaning and preparation of the melon seeds (Egusi):

The melon seeds were hulled, sorted manually in order to remove the rotten seeds, stones and other impurities. These cleaned melon seeds were then washed with clean water.

Production of *Ogiri* (Fermented *Citrullus vulgaris* seeds)*:* The washed melon seeds (500g) were then boiled for 4h, then allowed to cool to a about 30^0C, mashed and wrapped in small portions (15g) with the different leaves namely: Miraculous fruit leaves *(Thaumatococcus daniellii)*, banana leaves*(Musa sapientum)* and cocoyam leaves *(Colocasia esculentum)* and tied with palm frond ropes. After which the samples were enclosed in a plastic container and allowed to ferment for five days at a temperature of 28 ± 2^0C and the samples were allowed to develop the characteristic aroma as described by Akinyele and Oloruntoba, (2013). The flowchart for the production of Ogiri-egusi is shown in Fig.1.

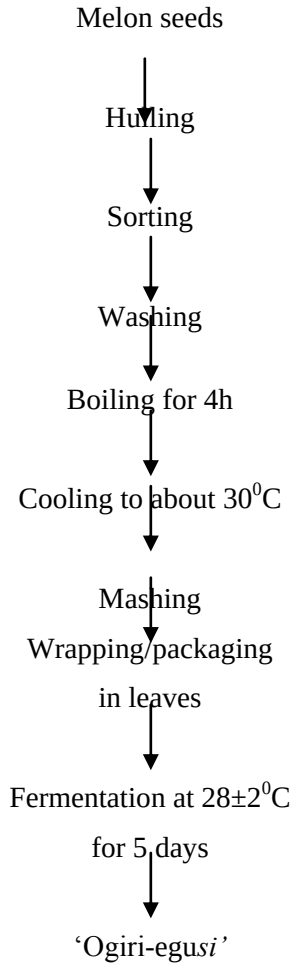

Fig. 1: Flowchart for production of Ogiri-egusi (fermented *Citrullis vulgaris).*

2.2 Proximate analysis of Ogiri-egusi samples

The proximate compositions were determined according to the AOAC (1990). Samples were analyzed for fatty acids, crude fiber, crude protein, moisture content, ash content and carbohydrate percentage was determined by difference, i.e. the difference between the total summations of percentage moisture, ash, crude fiber, fat and protein; 100% - (a + b + c + d + e) = % carbohydrate

Where a = % moisture
b = % ash
c = % crude fiber
d = % fat
e = % crude protein

2.3 Sensory evaluation of Ogiri-egusi samples

The organoleptic evaluation of the Ogiri-egusi (fermented *Citrullus vulgaris* seeds) samples wrapped in different leaves was carried out for consumer acceptance and preference by 10-man trained panelists (from the University community, Federal University of Technology, Owerri, Nigeria). The Panelists evaluated the sensory properties based on aroma, taste, texture, appearance and overall acceptability using a 9-point hedonic scale, (where 1 means 'extremely dislike' and 9 means 'extremely like' respectively (Ihekoronye and Ngoddy, 1985). Nevertheless, precautions were taken to prevent carryover of flavour during tasting by making sure panelists rinse their mouths with water after evaluation of each sample.

2.4 Statistical Analysis

Statistical analysis of data was by Analysis of Variance (ANOVA) using 95% level of significance. The separation of means was carried out using Fisher's least Significant Difference (LSD) and the significant difference and Similarities of the samples were determined.

3. RESULTS AND DISCUSSION

3.1 Proximate composition

Table 1 shows the effect of different wrapping materials on the proximate composition of *Ogiri-egusi* (fermented *Citrullus vulgaris* seeds).

3.1.1 Moisture content of Ogiri-egusi samples

The mean moisture contents of the samples ranged from 3.67% to 29.17%. The different food packaging materials (wrapping leaves) used has different ability for absorbing and retaining moisture. Sample *(Ogiri-egusi)* wrapped in cocoyam leaves (CL) had the highest mean moisture value of 29.17% while the sample wrapped in banana leaves (BL) had the lowest mean moisture value of 3.67%. These variations observed in moisture could be due to the difference in the wrapping materials used. Since the same sample was used, the banana leaves may have retained more moisture than the other samples during the fermentation period or the other materials may have lost moisture during the fermentation period. Hence, there was significant $P<0.05$ difference in moisture between the samples wrapped in Miraculous Fruit leaves, banana leaves and cocoyam leaves.

3.1.2 Crude Protein contents of Ogiri-egusi samples

The protein contents of the *Ogiriegusi* samples were 11.09%, 12.93% and 15.75% for miraculous fruit leaves, banana leaves and cocoyam leaves, respectively. The protein contents were significantly different at 95% confidence interval (Table 1), the sample wrapped with cocoyam leaves (CL) had the lowest percentage protein content (11.09%) and sample wrapped in banana leaves had the highest protein content (15.75%). Generally, the protein content of all the samples was relatively high because the melon seed is a good source of protein (Ogueke *et al*, 2012).

TABLE 1: The mean values of proximate composition of *'ogiri-egusi'* samples (%).

Samples	Moisture	Protein	Fat	Crude Fibre	Ash	CHO
MFL	7.64^{b}	12.93^{b}	7.83^{b}	4.00^{b}	3.50^{b}	66.27^{a}
BL	29.17^{a}	15.75^{a}	9.83^{a}	14.00^{a}	3.67^{a}	64.08^{b}
CL	3.67^{c}	11.09^{c}	6.5^{b}	3.00^{b}	7.00^{b}	30.40^{c}
LSD	0.30	0.26	1.89	3.83	1.77	1.01

Means in the same column with the same superscript are significantly similar ($p < 0.05$)
Key:
MFL = Miracle fruit leaves *(Thaumatococcus danielli)*
BL = Banana leaves *(Musa sapientum)*
CL = Cocoyam leaves *(Colocasia spp)*

3.1.3 Crude fat content of Ogiri-egusi samples

The fat content of the *Ogiri-egusi* wrapped in banana leaves had relatively higher fat content (9.83%) than those of other samples while cocoyam leaves had the lowest percentage of fat content (6.50%) and this could be due to the wrapping material variations as the different leaves used may have influenced the high fat content of sample (Ogueke *et al, 2012).*

3.1.4 Ash content of the Ogiri-egusi samples

The ash content of the O*giri-egusi* ranged from 3.50% to 7.00%. The ash contents of miracle fruit leaves and cocoyam leaves were significantly similar (values being 3.50% and 7.00%, respectively), but the sample wrapped in banana leaves was significantly different with the value 3.67%.

3.1.5 Crude fiber content of Ogiri-egusi samples

The crude fiber content ranged from 3.00% to 14.00% with Miracle Fruit leaves and Cocoyam leaves being significantly similar (having values 3.00% and 4.00% respectively), while the sample wrapped in banana leaves was significantly different with a very high value 14.00%.

3.1.6 Carbohydrate content of Ogiri-egusi samples

The carbohydrates percentage mean values ranged from 30.40% to 66.60%.There were significant difference in carbohydrate contents among the *Ogiri-egusi* samples (Table 1).

3.1.7 Effects of wrapping materials on the proximate composition of Ogiri-egusi

The proximate compositions of these *Ogiri-egusi* samples were so because they were from the same mixture, the differences were from the wrapping materials used. Therefore, any difference in proximate values could be that the wrapping material could have allowed some nutrient to leach out (signifying lower proximate values or the leaves may have contained the materials and did not allow nutrients to leach out (hence the high proximate values observed in such samples).

3.2 Organoleptic characteristics of Ogiri-egusi samples wrapped in different wrapping materials.

Table 2 shows the percentage mean sensory characteristics values of *Ogiri-egusi* samples wrapped in different wrapping materials.

3.2.1 Colour of the Ogiri-egusi samples

The colour of the sample wrapped in Miracle fruit leaves had mean sensory score of 4.50 (i.e. neither like nor dislike) and was significantly similar to banana leaves and cocoyam leaves. Generally, the colour of all the samples were either disliked slightly (score approximately 4), neither liked nor disliked (Score approximately 5) and liked slightly (score approximately 6), though they were significantly similar as observed by the panelists (Table 2).

3.2.3 Aroma of Ogiri-egusi samples

The aroma of the *Ogiri-egusi* samples were significantly ($P<0.05$) similar and all the samples were 'neither liked nor disliked' (score approximately 5.0). The aroma of the sample wrapped in cocoyam leaves was given the highest rating (5.40), followed by banana leaves (4.90) and miracle fruit leaves (4.50).

3.2.4 Taste of Ogiri-egusi samples

The acceptance sensory mean values for taste of *Ogiri-egusi* sample wrapped in miraculous fruit leaves, cocoyam leaves and banana leaves were 7.90, 6.10 and 7.30, respectively. The taste of

MFL and BL were significantly ($P<0.05$) similar while that of CL was significantly different. The taste of sample wrapped in MFL was 'liked very much' (score approximately 8.0) and that of CL was 'liked slightly' (score approximately 6.0) while that of BL was 'liked moderately' (score approximately 7.0).

Table 2: Mean score of organoleptic characteristics of *Ogiri-egusi* samples wrapped in different wrapping materials.

Sample	Colour	Aroma	Taste	Texture	Overall acceptability
MFL	5.60^{bc}	4.50^{abc}	7.90^{a}	4.90^{abcd}	4.60^{de}
BL	5.70^{ab}	5.40^{abc}	$6.10d^{e}$	5.10^{ab}	5.00^{bcd}
CL	5.40^{abc}	4.9^{ab}	7.30^{ab}	4.80^{abcd}	5.50^{abc}
LSD	1.97	1.87	1.72	1.33	1.45

Means in the same column with the same superscript are not significantly different ($p < 0.05$).

KEY:

MFL = Miracle fruit leaves *(Thaumatococcus daniellii)*

CL = Cocoyam leaves *(Colocasia spp)*

BL = Banana leaves *(Musa sapientium)*

3.2.5 Texture of Ogiri-egusi samples

The texture of all the samples was significantly similar and were neither 'liked nor disliked' (score approximately 5). This could be as a result of proper grinding of the melon seeds. The texture of the sample CL was rated highest with mean score 5.10.

3.2.6 Overall acceptability of Ogiri-egusi samples

The overall acceptability of all the sample showed that sample wrapped in BL was 'slightly liked' (score approximately 6.0) and was significantly similar to CL but significantly different from MFL which was 'neither liked nor disliked' (score approximately 5.0). Hence, sample wrapped in CL (cocoyam leaves) was rated best in overall acceptability according to the Panelists.

3.2.7 Organoleptic characteristics of soups prepared using Ogiri-egusi samples as condiment

Table 3 shows the mean value of the sensory properties of bitter leaves (*Onugbu*) soup prepared with *Ogiri-egusi* samples.

3.2.8 The consistency of soups prepared using Ogiri-egusi samples as condiment

The consistency of the soup prepared using sample wrapped in MFL had mean value of 6.50 ('moderately liked') and was significantly similar to CL (6.0) ('slightly liked') and BL (6.7) ('moderately liked').

Colour of soups prepared using *Ogiri-egusi* samples as condiment

Generally, the colour of all the samples were either 'slightly liked' (score approximately 6.0) or 'moderately liked' (score approximately 7.0). This could be as a result of the same method of preparation of the soup (*onugbu* soup- Bitter leaves soup).

Table 3: Mean value of organoleptic characteristics of *onugbu* soup seasoned with ogiri-egusi samples (wrapped in different wrapping materials).

Sample	Colour	Aroma	Taste	Consistency	Overall acceptability
MFL	6.5^{ab}	6.0^{abc}	7.9^{a}	6.5^{abc}	7.1^{abc}
BL	6.2^{ab}	6.2^{abc}	6.1^{de}	6.0^{bcd}	6.2^{cd}
CL	7.0^{a}	6.8^{ab}	7.3^{ab}	6.7^{ab}	7.3^{cd}
LSD	2.18	1.71	1.72	1.52	1.66

Means in the same column with different superscript are significantly different ($p < 0.05$).

KEY:

MFL = Miracle fruit leaves *(Thaumatococcus daniellii)*

CL = Cocoyam leaves *(Colocasia spp)*

BL = Banana leaves *(Musa sapentum)*

3.2.9 Aroma of soups prepared using Ogiri-egusi samples as condiments

The aroma of all the *Ogiri-egusi* seasoned soups was significantly similar. The aroma of sample wrapped with BL was given the highest score 7.0 ('moderately liked') and the sample wrapped in CL score 6.2 (approximately 6.0 that is 'slightly liked').

3.2.10 Taste of soups prepared using Ogiri-egusi samples as condiment

The taste of the soup samples were significantly similar for MFL and BL were either 'moderately liked' (score approximately 9.0) or 'liked very much' (score approximately 8) while CL was significantly different with mean score of approximately 6.0 ('slightly liked').

3.2.11 Overall acceptability of soups prepared using Ogiri-egusi samples as condiments

The overall acceptability of all the samples showed that soup prepared with samples wrapped in MFL and BL were significantly similar and were ''moderately liked (score approximately 7.0) while that prepared with samples wrapped with CL was significantly different and 'slightly liked' (score approximately 6.0). Generally, soup prepared with samples wrapped with BL were best accepted in all sensory parameters except in taste (Table 3).

4. CONCLUSION

From the three different wrapping materials used, *Ogiri-egusi* samples wrapped in banana leaves were best in all parameters accept for taste and overall acceptability according to the panelists. The different number of leaves used was slightly varied and did not affect the proximate composition of fermented melon seeds *(Citrullus vulgaris)* as so the different wrapping materials. Samples wrapped in banana leaves was rated as the highest in moisture content, crude protein, crude fiber and fat with scores 29.17%, 15.75%, 14.00% and 9.83%, respectively except in ash and carbohydrates whose scores were 3.67% and 64.01% while that of sensory evaluation showed that banana leaves was rated the highest in colour, aroma and texture with mean scores 5.70 ('slightly liked'), 5.40 ('neither liked nor disliked') and 5.10 ('neither liked nor disliked'), respectively, Miracle Fruit Leaves had the highest score in taste with mean score 7.90 ('liked very much') and cocoyam leaves had the highest in overall acceptability with mean score 5.50 ('slightly liked'). Banana leaves had higher wrapping quality and nutrient value and is therefore the best wrapping material for *Ogiri-egusi* production.

5. RECOMMENDATION

Banana leaves, being a wrapping material can be sourced locally. Further work should be carried out on the effect of different number of leaves on the product.

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