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Effect of wrapping material on proximate and sensory qualities of Ogiri, a fermented melon seed (*Citrullus vulgaris L. series*) product

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ABSTRACT

Melon seeds (*Citrullus vugaris L. series)* were sorted, a batch was dehulled while another batch was undehulled. The two batches were washed and boiled (4hours). They were then allowed to cool, and the undehulled sample was dehulled. Thereafter, both were saparately wrapped in blanched plantain leaves and boiled again for 2 hours; drained; cooled and allowed to ferment naturally for 72 hours (primary fermentation). After primary fermentation, the proximate compositions of both samples from dehulled and undehulled melon seeds were evaluated and compared. Higher proximate composition was discovered from the undehulled melon seed, hence, the fermented melon seeds used for further analysis. They were mashed and wrapped in six different wrapping materials (unblanched leaf, blanched leaf, aluminum foil, dried leaf, transparent polyethylene, black polyethylene), and later stored at room temperature for another 72 hours (secondary fermentation). The end product is locally known as *Ogiri-egusi* (or *Ogiri*), a local condiment with characteristic flavor attribute. The proximate and sensory qualities of the resultant *Ogiri* samples wrapped with different materials were subsequently evaluated, and statistical evaluation of data obtained from the analysis showed that the modern packaging materials (aluminum foil, black polyethylene, and black polyethylene materials) sustained and improved the sensory qualities of *Ogiri-egusi*, with the black polyethylene being the best followed by the aluminum foil. Proximate composition of the sample wrapped with modern packaging materials also compared favourably with samples wrapped with traditional packaging materials (unblanched, blanched, and dried leaves).

KEYWORDS

Ogiri-egus;
Fermented melon seed;
Packaging/wrapping;
Effects;
Proximate composition;
Sensory quality;
Condiment.

INTRODUCTION

Food packaging is an integral part of food processing and entails the use of some materials in the packaging of foods[6]. It is a means of providing the right environmental conditions for a food material[1] and it covers the development of packages and packaging systems examining all aspects that are relevant to processing, preservation, distribution and marketing of virtually all types of food[9]. The success of most preservation methods depends on appropriate packaging, thus packaging should be regarded as an integral part of food processing and preservation[6]. However, faulty packaging will undo all that a good processor has attempted to accomplish by the most meticulous manufacturing process.

The earliest forms of packaging predate written history and were found in nature, and progressed as man made advancement in the production of food. Leaves, skin of goats, woods, leathers, etc. were traditional packaging materials used by the early man[6].

The beginning of modern packaging originated from the industrial revolution which changed the structure of society and concentrated large numbers of people in towns and cities, so altering their habits and creating a great demand for similar qualities of various products in large replication[1]. Today, packaging materials such as glass, metals (like tinplates, tin-free steel and aluminum), plastics (like homogenous films, coated films, cellophanes, etc.), papers (e.g. paper boards and fibre boards) and laminates are now being widely used[1].

Although the early man developed his own packaging using leaves for wrapping purposes, and the skins of goat as the first flexible packaging material in the transport of water and wine[1], the use of leaves is still being widely practiced, especially in the packaging of indigenous fermented products like *Ogiri, Ugba, Iru,* etc.

African, and indeed Nigeria, are endowed with a wide range of indigenous fermented foods, which are prepared by traditional methods of uncontrolled solid substrate fermentation, resulting in extensive hydrolysis of the protein and carbohydrate components[8], which are traditionally packaged with leaves, example *Ogiri* and *Ugba*.

Ogiri-egusi, a product of indigenous fermentation of melon seeds[10] is one of such numerous fermented products faced with the problem of industrialization. Its poor, ineffective and unattractive leaf-packaging has led to the products' very short shelf-life and reduced commercial usage[4]. Therefore, it is highly important that an appropriate packaging material that will effectively preserve *Ogiri-egusi*, increase its shelf-life, and at the same time, be a good marketing tool for its commercialization be investigated and developed.

This objective of this study is therefore to produce *Ogiri* from melon seed, ascertain the effect of various packaging materials (local and modern) on the proximate composition of *Ogiri* from melon seed (*Citrullus vulgaris)*, and evaluate the sensory qualities and acceptability of *Ogiri-egusi* packaged with the selected local and modern packaging materials.

Awan and Okaka[5] reported that leaves do not offer maximum protection to its content against microbial attack, moisture and oxygen and possess low ability to withstand environmental stress. This may be the reason for the very short shelf-life of *Ogiri-egusi*. However, if these leaves are treated, a better protection may be achieved. Again, if modern packaging materials such as aluminum foils and polyethylene, as will be used in this study, are embraced in the packaging of this condiment, the shelf-life of *Ogiri-egusi* may be extended, since the objectives of the functions of modern packaging are to extend shelf-life of products, as well as for convenience. Therefore, it is hoped that at the end of this research work, an effective packaging material that can maintain or improve the proximate and sensory qualities of *Ogiri-egusi*, as well as offer adequate preservation, extend the shelf-life, offer convenience during usage, cheap and readily available and possess a good marketing attribute to the commercialization of *Ogiri-egusi* would be discovered.

The success of this research will help to proffer solution to the problem of packaging encountered in *ogiri* production which has delayed its industrialization to a large extent. Also, the packaging materials for *ogiri* which played the role of preserving the condiment by retaining its nutritional composition would be discovered in the course of this study.

MATERIALS

Plant material

Melon seeds *(Citrullus vulgaris L. series)* were purchased from a local seller at Abeokuta, Ogun State, Nigeria. Some packaging materials such as aluminum foil and polyethylene films were purchased from a store

Full Paper

at Ihiagwa, Owerri west L.G.A, Imo State.

Chemicals

Chemicals such as formaldehyde, potassium oxalate, n-hexane were purchased from stores at Douglas and Mbaise road in Owerri while others such as sodium hydroxide, sulphuric acid, phenolphthalein, ethanol were obtained from the laboratory of the department of Food Science and Technology, Federal University of Technology, Owerri. All chemicals and reagents used were of analytical grade.

Equipment

Equipment used was mostly sourced from the department of Food Science and Technology and they are as follows: Muffle furnace (Carbolite Bamford, Sheffield, England, 530 2AU), Desiccator, Sohxlet apparatus, Hot air oven (Genlab, model –MINO/50, Serial No-10CO76), Analytical sensitive balance (item No: AR3130, OHAUS corp, China), Kjedhal apparatus, hot plate, scientific mortar, measuring cylinder, pipette, beaker and conical flask, thermometer, pH paper, crucible, petri dish, etc.

METHODS

Preparation of samples

Undehulled and dehulled melon seeds were subjected to cooking for 4-hours and subjected to proximate analysis in comparison with raw melon seed. After cooking, the undehulled and dehulled were milled separately.

Traditional production of fermented melon seed (*Ogiri*)

This was carried out using the method according to Iwuoha and Eke[3]. Undehulled melon seeds were washed properly and severally and boiled for 4 hours, cooled and dehulled. The cotyledons were then soaked in water overnight and wrapped tightly in layers of blanched plantain leaves and afterwards perforated with glass rod. The wrapped cotyledon was subsequently boiled for 2 hours, place on a wire mesh over flame in order to reduce the moisture content for 1 hour. Thereafter, the wrapped cotyledon was left to ferment at the prevailing ambient temperature (28^{O}C) for 3 days (pri-

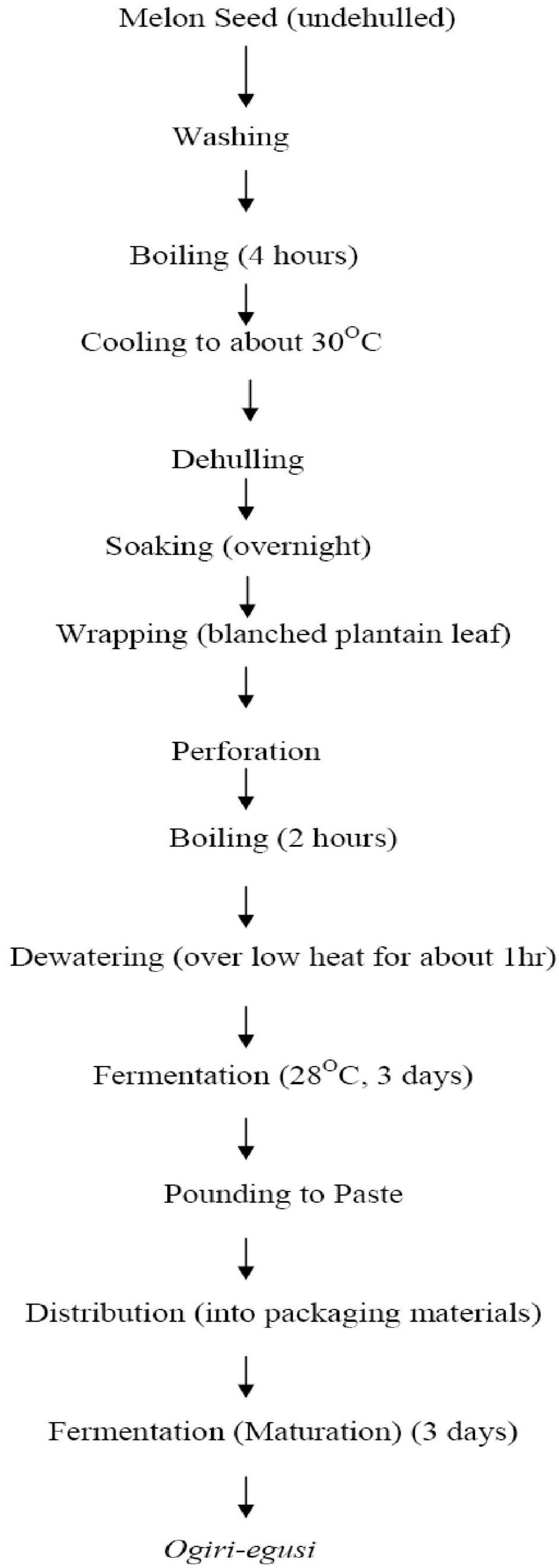

Figure 1 : Flow chart for traditional production of *Ogiri*

TABLE 1 : Proximate composition of melon seed at raw and primary fermentation stage

Samples	Moisture	Fat	Ash	Protein	Crude	Carbohydrate
Raw sample	5.18^{d} ±0.08	53.13^{a}±0.40	2.72^{b}±0.10	25.94^{a}±0.06	6.17^{d}±0.03	6.86^{a}±0.03
Undehulled and Cooked	21.93^{a}±2.17	41.36±2.17	1.39^{c}±0.20	22.68^{b}±0.03	5.63^{a}±0.06	7.01^{b}±0.06
Dehulled and Cooked	23.89^{b}±0.05	39.97^{d}±0.45	2.93^{a}±0.03	21.83^{c}±0.05	5.34^{a}±0.05	6.04^{d}±0.02
Fermented Sample after 72 hours	28.51^{a}±3.3	44.60±3.30	1.22^{b}±0.08	21.08^{d}±0.08	3.34^{c}±0.06	1.25^{c}±0.06

***All values are means of four determinations in percentage (%). Means on the same column with different superscripts differ significantly at p≤0.05.**

TABLE 2 : Proximate composition of melon after secondary fermentation

Samples Package	Moisture	Fat	Ash	Protein	Crude fibre	Carbohydrate
Unblanched Leaf	30.87^{b} ±0.15	43.22 ^{a}±0.10	1.37^{e}±0.06	19.78^{d}±0.24	0.34^{a}±0.02	4.42^{a}±0.12
Blanched Leaf	30.25^{b}±0.39	36.25^{b}±4.02	1.68^{b}±0.19	26.25^{c}±3.89	0.24^{ab}±0.06	5.33^{a}±0.16
Dried Leaf	29.90^{b}±0.56	37.18 ^{b}±3.49	1.43^{c}±0.07	29.75^{a}±5.64	0.25^{ab}±0.05	1.49^{c}±0.61
Aluminum Foil	31.86^{a}±0.88	36.42^{b}±3.75	1.38^{d}±0.06	29.15^{a}±5.62	0.34^{c}±0.02	0.85^{d}±0.69
Transparent Polyethylene	31.27^{a}±0.28	31.78 ^{c}±6.60	1.70^{a}±0.20	28.31^{b}±5.08	0.25^{ab}±0.05	6.69^{a}±0.12
Black Polyethylene	30.35^{b}±0.33	30.43^{d}±7.4	0.88^{f}±0.29	26.19^{c}±2.71	0.34^{a}±0.02	11.81^{b}±0.38

***All values are means of four determinations in percentage (%) ± SD. Means on the same column with different superscripts differ significantly at pd≤0.05.**

TABLE 3 : Result for sensory evaluations

Samples	Taste	Aroma	Colour	Mouth Feel	Appearance	Overall Acceptance
Unblanched Leaf	5.3^{d}±2.00	6.6^{c}±1.43	4.2^{d}±1.39	6.0^{c}±1.25	3.4^{d}±1.51	6.2^{c}±2.17
Blanched Leaf	5.3^{e}±2.06	6.4^{c}±1.17	5.2^{c}±1.14	5.8^{c}±1.48	5.3^{c}±0.82	6.3^{c}±2.00
Dried leaf	5.55^{ed}±1.95	6.3^{c}±2.41	3.8^{c}±2.25	5.8^{c}±0.79	4.4^{c}±0.82	5.9^{c}±1.45
Aluminum Foil	8.4^{a}±1.56	6.7^{b}±1.49	7.7^{a}±0.95	6.0^{b}±1.49	6.5^{b}±0.95	6.2^{c}±2.04
Transparent Polyethylene	5.7^{b}±0.67	6.4 ^{a}±1.43	4.7^{c}±2.31	5.9^{c}±1.37	5.6^{c}±1.10	6.4^{b}±1.65
Black Polyethylene	5.3^{c}±2.27	7.9^{a}±1.29	8.5^{a}±0.71	7.7^{a}±1.57	7.7^{a} ±1.60	8.2^{a}±0.79

***All values are expressed in percentage (%) ± SD. Values on the same column with different superscripts differ significantly at pd≤0.05.**

mary fermentation). At the end of the fermentation period, the seeds were pounded in a scientific mortar with pestle into a paste. The paste was then distributed into the various packaging material which comprises of unblanched leaf, blanched leaf, dried leaf, aluminum foil, transparent polyethylene and black polyethylene and left to ferment for another 3 days (secondary fermentation).

Proximate analysis of sample

This was determined on the raw and processed melon seeds and at primary and secondary fermentation stages by using the methods as described by AOAC (2000).

RESULTS AND DISCUSSION

Result of proximate composition

Proximate composition of melon seed after primary fermentation

The statistical evaluation (TABLE 1) conducted on the raw; dehulled and cooked; undehulled and cooked; and fermented sample (primary fermentation) showed significant difference at pd≤0.05 for moisture content, crude protein and carbohydrate contents. Boiling increased the moisture content of melon seed, fermented sample having the highest followed by dehulled and cooked sample. Also, the ash content of the raw was higher, dehulled and cooked having the least. Protein slightly reduced after primary fermentation, however, undehulled and cooked was close to the raw melon seed in crude protein, crude fibre. The lower the moisture content, the more the total solids (carbohydrate). The fat content showed no significant difference amongst the four samples. The significant differences observed would be attributed to the effect of cooking on the legumes. Cooking breaks down the anti-nutrient in legumes thereby releasing lockup nutrients. The difference between the dehulled and undehulled would be as a result of the protective nature of the hull. The hull prevented the leaching out of nutrients into the cooking water which resulted to an increase in the proximate composition when compared to the dehulled sample. It was decided that *Ogiri* production should be carried out with undehulled melon seed since it is evident that the hull prevents leaching out of nutrients from the seeds during cooking.

Proximate composition of melon seed after secondary fermentation

The proximate analysis result of *Ogiri* samples packaged in various packaging materials (after secondary fermentation) is shown in the TABLE 2. Aluminum foil, which had the highest value of moisture content, showed significant difference in same among other packaged samples at pd≤0.05. This could be attributed to the non-porous nature of aluminum foil. The sample in unblanched leaf sample showed higher significant difference in fat compared to the others at pd≤0.05, but least protein content. Dried leaf and aluminum foil showed significant difference at pd≤0.05 in their crude fibre content, ash content and carbohydrate contents.

Result of sensory evaluation

Data collected from the sensory evaluation were analyzed with Analysis of Variance (ANOVA) and the result is presented in TABLE 3. Significant difference existed at pd≤0.05 between samples wrapped with packaging materials in taste, aroma, colour, mouth feel and overall acceptance. On the other hand, samples packaged with differently treated leafy (traditional) wrapping materials showed no significant difference in their aroma, mouth feel and overall acceptance. However, samples wrapped in blanched and dried leaves were not significantly different at pd≤0.05 in their colour and appearance, but differed significantly in colour and appearance with sample wrapped with unblanched leaf.

Generally, it was found that the modern packaging materials (aluminum foil, black polyethylene and transparent polyethylene) produced most of the highest scores in sensory quality evaluation when compared to the conventional (leafy) materials with the sample packaged with the black polyethylene material being the best followed by the sample wrapped with aluminum foil.

It was therefore deduced that black polyethylene and aluminum foil were preferred.

CONCLUSION

Result of this study suggests that in comparison with the conventional wrapping material (leaf), black polyethylene and aluminum foil could be used in wrapping *Ogiri* beginning from primary fermentation down to the secondary fermentation stage without affecting the nutritional content and sensory attribute but instead preserving these quality parameters and improving aesthetic qualities and acceptability. These modern wrapping materials could proffer better preservation and presentation of *Ogiri* to the global community.

RECOMMENDATION

Attempts should be made to produce the *Ogiri* in dry powdered form and study the proximate and sensory qualities as well as the acceptability in comparison with the usual paste form. It is expected that the dried form will be favoured by packaging in foil or tetra packs for easy labeling, modern sealing (closure) and presentation. The shelf-life may also be extended.

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