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Quality Evaluation of Tunnel Dried 'Ogiri'

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ABSTRACT

'Ogiri' is an indigenous fermented soup condiment that once popular in South-West Nigeria but its usage nowadays has been limited to remote villages and rural dwellers. This has been due to inadequate nutritional information on the condiment. In this study, melon seeds were sorted and boiled to soften the melon seeds, the samples were allowed to ferment 72 hours. These fermented samples were dried in the tunnel dryer at different temperature of 40^{O}C, 50^{O}C and 60^{O}C. The dried 'ogiri' samples were analyzed for proximate composition, functional properties and sensory evaluation. The results of proximate composition showed that moisture content ranged from 10.68 to 13.90%, the ash content ranged from 3.12 to 3.32 %, the fat content ranged from 10.0 to 12.7 %, the protein content ranged from 8.0 to 8.7%, the crude fiber content ranged from 4.51 to 4.7 %, and carbohydrate (56.7 to 63.0) %. The functional properties of 'ogiri' samples results were: bulk density ranged from 1.13 to 1.16g/ml, water absorption capacity ranged from 10.0 to 12.4 cm3/g, emulsifying capacity ranged from 5.02 to 6.83 mg/g, emulsifying stability ranged from 8.00 to 8.45, swelling properties ranged from 1.15 to 1.45 g water/g sample, and FFA ranged from 0.013 to 0.016 mg KOH/g. The sensory evaluation 'ogiri' samples showed that samples dried at 50^{o}C had overall acceptability.

Keywords: Ogiri', Tunnel dryer, proximate, functional, sensory attributes.

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1. INTRODUCTION

'Ogiri' is a food condiment produced from the fermentation of melon seed and is adjudged to be an indigenous fermented soup condiment which is used as flavoring agent whose character and organoleptic properties depend on microbial activities [1]. It has gray colour with porous structure and sharp smell when in a raw state but the dried form has less pungent smell. The production of 'ogiri' has been limited to household level and only women are involved in its production. This condiment is consumed among the 'Yorubas' and 'Igbos' who are largely found in South Western and Eastern part of Nigeria. The production of 'ogiri' involves solid fermentation of melon seeds. The step by step production involves boiling of raw melon seeds and the water is drained. The seeds are allowed to ferment naturally for three to five days in clay pots. The fermented seeds are then mashed into pastes, wrapped in leaves and kept over a fire place to dry. Because of the natural fermentation, the products vary in pungency depending on fermentation time and melon seeds [2]. Apart from regular melon seed (*Citrulus lanatus*) used for 'ogiri' preparation, it can also be produced from castor oil seeds (*Ricinus cummunis)*as reported by Enujiugha [3] and fluted pumpkin (*Telfairia occidentalis)* by Omafuvbe and Oyedapo [4]. These other melon seeds which are underutilized can serve as alternative substrates for the production of 'ogiri' thereby increasing their utilisation.

Quite numbers of researchers have worked on 'ogiri', for instant; Chika, et al. [5] worked on free and attached cell of *Bacillus subtills* in the production of 'ogiri'. Sanusi, et al. [6] worked on energy usage in the production of 'ogiri' while [7] has studied the effect of wrapping material on physical-chemical and functional properties of 'ogiri'. However, the production of 'ogiri' through convectional drying on earthen fire in which smoke is used as the drying agent poses some quality challenge on the product. First, smoke poses health challenges on food as some wood smoke can induce cancer as reported by Agency for Toxic Substance and Diseases Registry (ATSDR) [8]. Besides, one side of the wrap is burnt whereas the other side is not baked as a result of uncontrolled temperature of the earthen fire. This renders its quality to be low. Hence, there is need to source for alternative use of mechanical dryer with temperature control sensor such as tunnel dryer to dry the product. This forms the thrust of the study. Therefore, the aim of this work is to use tunnel dryer to dry 'ogiri' and determine the proximate, functional, and sensory properties of the samples

2. MATERIALS AND METHODS

The melon seeds used for this work were gotten from Sabo market, Ogbomoso Oyo State. Other reagents include H_2SO_4, $HN0_3$, and HCL and were of analytical grade

(a) Preparation of Ogiri

Melon seeds were sorted weighed and rinse in potable water. Equal weights of 2kg were measured in a clean pressure pot. Melon seeds were put inside the cooking pot accompanied with miracle berry leaves (Thaumatococcus danielli), four litter of distil water was added and boiled at 100^{o}C to soften the melons. The water were decanted from the cooked melon seeds and were wrapped with giant yellow mulberry leaves,(*Myrianthus arboiens*) for 3 days for fermentation to take place.The fermented melon seeds were put inside the tunnel dryer and dried at temperatures of 40, 50 and 60^{O}C. Then, it was removed from the dryer and blended with a blending machine (750W Sapphire brand) to form a sticky powder. It was package in a tight different container and labeled appropriately for further analysis to take place. The flowchart of its production is as shown in Figure 1

(b) Nutritional Analyses on the Samples

(i) Proximate Composition Analysis

The **o**fficial methods of analysis of the AOAC [9] was used to determine the proximate composition of the 'ogiri' samples

(ii) Functional Properties

The Official methods of analysis of the AOAC [9] were used to determine some functional properties of 'ogiri' samples. The properties were gel strength, free fatty acid (FFA), emulsifying capacity, and emulsion stability. However, bulk density was determined using procedure of Akpapunam and Markakis [10] swelling capacity was determined using the method described by AOAC [9] and water absorption capacity was determined using the procedure of Salthe , et al. [11].

(iii) Sensory Analysis

Sensory evaluation based on the sensory attributes was conducted by using a standard nine points hedonic scales method (where 1 = dislike very much and 9 = like very much) as described by Larmond, et al. [12]; Larmond [13]. A total of 30 semi-trained panelists aged 18 and above years old were involved in the sensory evaluation of the 'ogiri' condiment for colour, flavour, texture, taste and overall acceptability. Among these panelists, 13 and 7 were males and females, respectively. The ogiri' samples were made into soup. These soups were coded with 3-digit random number using statistical random tables and served to the panelists at around 12.15 pm with distilled water for rinsing the mouth after every sample taste in a randomized order. The panelists was instructed to rate the attributes indicating their degree of liking or disliking by putting a number as provided in the hedonic scale according to their preference.

(iv) Statistical Analysis

All determination of proximate composition, thermal and functional properties analyses as reported in this study were carried out in triplicates. In each case, a mean value was calculated and analysis of variance (ANOVA) was also performed and separation of the mean values was done by Duncan's multiple range tests at p≤ 0.05 using Statistical Analysis System (SAS) software, version 10.0.

3. RESULTS

The results of the proximate, functional, thermal composition and functional properties with the sensory evaluation of the 'ogiri' are as presented.

(a) Proximate Composition of 'Ogiri'

The moisture contents of the 'ogiri' samples ranged from 10.68 to 13.90% and were significantly different from each other. The ash content of the samples had no significant difference from each other and it ranged from 3.12 to 3.32 %. The values for lipid content of the samples ranged from 10.0 to 12.7 % and sample dried at 40^{o}C was significantly different from other samples. The protein content ranged from 8.089 to 8.789 % and were not statistically, significantly different.

Sorting and cleaning of shelled melon seeds

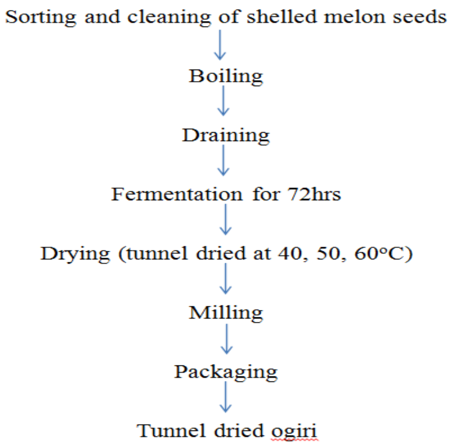

Figure-1. production of Ogiri

Source: 6 modified

The crude fiber content of the samples had values ranged from 4.51 to 4.77% and were not significantly different from each other

Table-1. Result of proximate analysis of 'Ogiri'

Samples	moisture %	ash %	lipid%	protein %	Fiber %	Carbohydrate %
40°C	13.90±0.02^{c}	3.30±0.18^{a}	12.7±0.71^{b}	8.789±0.33^{a}	4.56±0.62^{a}	56.75 ±1.45^{a}
50°C	12.97±0.06^{b}	3.32±0.39^{a}	10.0±0.14^{a}	8.633±0.11^{a}	4.51±0.01^{a}	60.27±0.31^{b}
60°C	10.68±0.01^{a}	3.12±0.08^{a}	10.0±0.28^{a}	8.089±0.22^{a}	4.77±0.29^{a}	63.06± 0.86^{b}

Source: From the experimental reulsts of this research

(b) Functional Properties

Table 2 shows the values of bulk density of the 'ogiri' samples which ranged from 1.13 to 1.16 g/cm^3. There were no significant differences between all the samples. The values of water absorption capacity of the 'ogiri' samples varied from 10.00 to 12.4% and exhibited no significant difference. The emulsifying capacity values of 'ogiri' samples are as shown in Table 2. The values are ranged from 5.07 to 6.83 ml of oil per g of soluble protein. There was no significant difference among the samples. The result of emulsifying stability of 'ogiri' is as shown in Table 2. The value increased from 8.0 for the samples dried at 40°C to 8.45 for the samples dried at 60°C which were significantly different from each other. The result of swelling capacity is as shown in Table 2. It shows that the samples exhibited no significant difference but sample dried at 40°C had the lowest value of 1.35 g water/g sample while sample dried at 60°C had the highest value of 1.45 g water/g sample. Also, Table 2 shows the values of free fatty acid of the 'ogiri' sample. It ranged from 0.013 to 0.016 mg KOH/g. All the samples had no significant difference at $P<0.05$.

Table-2. Result of functional analysis of Ogiri

Samples	BD	WA	EC	ES	SC	FFA
40°C	1.16±0.03^{a}	10.00±1.7^{a}	5.07 ±0.47^{a}	8.45±0.17^{b}	1.35±0.21^{a}	0.016±0.001^{a}
50°C	1.16±0.02^{a}	11.2±0.00^{a}	5.27±0.19^{a}	8.05±0.08^{ab}	1.45±0.07^{a}	0.015 ±0.00^{a}
60°C	1.13±0.02^{a}	12.4±1.70^{a}	6.83±1.80^{a}	8.00±0.15^{a}	1.45±0.07^{a}	0.013±0.001^{a}

Source: From the experimental reulsts of this research

Key:

BD: Bulk density (g/cm^3), WAC :Water absorption capacity (cm^3/g), EC:Emulsifying capacity (ml of oil per g of soluble protein), ES: Emulsifying stability, SC: Swelling capacity (g water/g sample), FFA:Free fatty acid (mgKOH/g)

(c) Sensory Evaluation

The results of sensory analysis are as shown in Table 3. The values for the colour ranged from 6.3 to 7.3 while the values for flavor ranged from 5.3 to 6.4. The values for texture at 60°C were 5.8 while value at 40°C was 6.1. The values for taste ranged from 5.5 to 6.9 while the for overall acceptability ranged from 6.1 to 6.7

Table-3. Result of Sensory Evaluation on ogiri

Samples	Colour	Flavour	Texture	Taste	Overall acceptability
40°C	6.5[a]	5.3[a]	6.1[a]	5.5[a]	6.1[a]
50°C	7.3[a]	6.4[a]	6.5[a]	6.9[a]	6.7[a]
60°C	6.3[a]	5.5[a]	5.8[a]	5.5[a]	6.2[a]

Source: From the experimental reulsts of this research

4. DISCUSSION

(a) Proximate Composition

Sample dried at 40°C showed the highest moisture content of 13.90% while sample dried at 60°C showed the least value of 10.68%. Sample dried at 60°C had better tendency for longer shelf life due to its lower moisture content. Lower moisture content confers reduction of water and microbial activity on dried food samples as reported by Ajala, et al. [14]. The value of moisture content in this work was less than the value of 'ogiri' reported by Enujiugha [3] which ranged from 33.4 to 34.6%.

The values of ash content were in close range with the value of melon seeds reported by Asagbra, et al. [15] with values range of 1.7 to 2.0%. The value of 'ogiri' lipid composition in this study was less than the value reported by Bankole, et al. [16] which ranged from 52.9 to 53.8%.

The protein content of each sample had no significant difference from each other and it ranged from 8.0 to 8.7%. The value of protein content in this work was less than the value reported by Asagbra, et al. [15] which ranged from 18.2 to 30.4%.

The value of crude fiber content in this study was greater than the value of melon seeds reported by Bankole, et al. [16] which ranged from 2.6 to 13.8%. The figures show that 'ogiri' sample is a poor source of fiber content.

All the samples were high in carbohydrate but sample dried at 40°C has the lowest carbohydrate content of 56.75 % however, there was no significant difference between the three samples. The value of carbohydrate content in this study was greater than the value reported by David and Aderibigbe [17] which ranged from 3.75 to 24.50%

(b) Functional Properties

The value of bulk density is less than the value of melon seeds reported by Adewusi, et al. [18] which ranged from 3.2 to 5.0 g/cm^3. Bulk density of the samples decreased as drying temperature increased from 40 to 60°C as shown in the table. This could be as a result of reduction of moisture content at higher temperatures. Ajala, et al. [14] have established that increase in drying temperature would decrease the moisture content in food samples. This decrease in moisture content would cause decrease in bulk density of 'ogiri' samples. Knowledge of bulk density value is useful in packaging and storage of foods; this will help in determining the space the sample will occupy during the storage. Water absorption capacity increased as the drying temperatures increased from 40 to 60°C as shown in Table 2. In other words, it has a direct relationship with the temperature at which the samples were dried. There were no significant differences between all the samples.

Increased water absorption capacity confers possible advantage of increased swelling during cooking which makes the soup thickened easily. The value of water absorption capacity in this work was greater than the value of winged beans reported by Salthe, et al. [19] which ranged from 6.5 to 8.4 cm^3/g. This may be due to the difference in the varieties of the melon used.

These values of emulsifying capacity in this work were less than the value of full fat and de-fatted white melon seeds reported by Fagbemi, et al. [20] which ranged from 85.5 to 115.5 ml of oil per g of soluble protein. Emulsifying capacity of a sample is defined as the maximum amount of oil that the 'ogiri' sample protein solution would emulsify without losing its emulsion quality.

The value of emulsifying stability was less than the value of melon seeds reported by Jackson, et al. [21] which ranged from 20.1 to 27.3. Temperature affects emulsion stability of 'ogiri' samples slightly. This confirms the observation of other researchers such as [22-24]. The conclusion of their findings shows that temperature affects the physical properties of oil, water, interfacial films, and surfactant solubility in the oil and water phases. These, in turn, affect the stability of the emulsion. Perhaps the most important effect of temperature is on the viscosity of emulsions because viscosity decreases with increasing temperatures. This decrease is mainly because of a decrease in the oil viscosity. Jones, et al. [25] stated that an increase in temperature led to a gradual destabilization of the crude oil/water interfacial films.

Temperature has effect on swelling capacity because as the drying temperature increased, the value of swelling capacity increased. There seems to be an inverse relationship between lipid content and swelling capacity. This is because, sample dried at 40^{o}C had highest value of lipid content as shown in Table 1 and swelling capacity decreased with increase in fat content by forming a complex with amylase which prevents the molecules from increasing viscosity. The value of swelling properties in this work was greater than the value of fatted and defatted pumpkin seeds reported by Fagbemi, et al. [20] which ranged from 3.15 to 11.75 g water/g sample.

The value of free fatty acid is less than the value of soy bean reported by Slađana, et al. [26] which ranged from 7.4 to 9.1 mgKOH/g. The values of free fatty acids decreased with increase in temperature at which the samples were dried. This is in agreement with the work of [26-28]. Free fatty acids are responsible for rancidity and spoilage of oily foods.

(c) Sensory Evaluation

The colour of the 'ogiri' sample was milky gray and Table 3 shows that there were no significant differences despite differences in drying temperature. However, the colour of sample dried at 50^{o}C was preferred to all other samples. The result of the flavor shows that there were no significant differences in the whole samples but the sample dried at 50^{o}C had the best flavor acceptability compare to other samples. The 'ogiri' samples were finely coarse in texture and Table 3 shows that there were no significant differences in the samples dried at different temperatures but the samples dried at 50^{o}C scored the highest acceptability from the panelists. The results of the taste shows that there were no significant differences in the samples but sample dried at 50^{o}C had preferable taste to other samples. Finally, Table 3 shows the results of overall appearance of the samples. There was no significant difference among the samples but samples dried at 50^{o}C had the best overall acceptability.

5. CONCLUSION

Careful analysis of the work shows that samples dried at higher temperature had lower moisture content and lipid which are the primary factors which determined the shelf life of ' ogiri' sample. Besides, samples dried at temperature of 60^{o} had reduced bulk density and increased water absorption capacity which could favour packaging and transportation. Also, samples dried at 60^{o}C had lower free fatty acids value which could reduce rancidity in the samples. However samples dried at $50^{o}C$ favoured the overall acceptability of the samples.

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