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Research Article
Sensory Attributes of Soups Prepared with Wet, Micro-Waved and Dried 'Ogiri' Produced from *Ricinus communis*

Onoriode C. Eruteya and Esther U. Iwuji

Department of Microbiology, Faculty of Science, University of Port Harcourt, Port Harcourt, Nigeria

Abstract

Background and Objective: 'Ogiri' is among the condiments that have played a major role in the soups and sauces in Eastern Nigeria; serving not only as a nutritious non-meat protein substitute but also as condiment and flavoring agent in soups. This study aimed to assess the proximate composition, microbiological and sensory quality of soups prepared with the wet, micro-waved and dried samples. **Materials and Methods:** 'Ogiri' samples were analyzed for moisture, ash, fat, protein, crude fibre and carbohydrate. Proximate composition of the Ogiri samples were determined using the AOAC method. **Results:** The proximate result revealed the presence of moisture (40.38, 1.20, 4.10%), carbohydrate (0.89, 1.47, 1.21%), protein (14.43, 16.62, 13.12%), ash (3.30, 4.40, 2.00%), lipid (40.20, 70.60, 64.95%) and fiber (1.69, 5.73, 14.62%) for the wet, micro-waved and 100°C dried samples respectively. The isolated bacteria on the basis of cultural morphology, physiological and biochemical characteristics were identified as: *Bacillus* spp. (32.0%), *Staphylococcus* spp. (10.0%), *Micrococcus* spp. (11.0%), *Pseudomonas* spp. (26.0%), *Proteus* spp. (16.0%) and *Lactobacillus* spp. (5.0%). The sensory evaluation of soups prepared with the 'ogiri' samples showed that the micro-waved sample had the highest overall acceptability, followed by the oven-dried sample and lastly the wet samples. **Conclusion:** Soup prepared with the micro-waved sample was the most preferred and had very low microbial counts.

Key words: Condiments, 'ogiri,' microbial count, Nigerian soup, *Ricinus communis*

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Corresponding Author: Onoriode C. Eruteya, Department of Microbiology, Faculty of Science, University of Port Harcourt, Port Harcourt, Nigeria

Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Fermented condiments used in soup are common in West Africa and are usually made from protein-rich leguminous plants and oilseeds[1]. Fermented soup condiments used in different parts of Nigeria include 'ogiri' from castor bean (*Ricinus communis*) or melon seed (*Citrullus vulgaris*), 'iru' or 'dawadawa' from African locust bean (*Parkia biglobosa*), 'okpei' from mesquite seed (*Prosopis africana*) and 'ugba' from African oil bean (*Pentaclethra macrophylla*)[1,2].

'Ogiri,' an oily paste from castor oil seeds is consumed in the eastern and the mid-western parts of Nigeria by about 5 million people[2]. The seeds which contribute protein, mineral and calories in diets, contain 4.3% oil, 19% protein and about 33% carbohydrate[3,4]. 'Ogiri' is prepared by traditional method of uncontrolled solid state fermentation of castor bean (*Ricinus communis*), melon seeds (*Citrullus vulgaris*) and fluted pumpkin (*Telfairia occidentalis*). This involves the use of natural inoculation or chance fermentation which is known to enhance the palatability, increases protein value, vitamin content and mineral levels of such condiments[1,5]. These raw materials are used to create different varieties of 'ogiri' such as 'ogiri isi,' 'ogiri-egusi' and 'ogiri-ugu'[6].

The major microorganisms associated with fermenting oil bean seeds are species of: *Bacillus*, *Micrococcus*, *Proteus*, *Pseudomonas*, *Leuconostoc*, *Streptococcus*, *Escherichia coli*, *Enterobacter*, *Staphylococcus*, *Lactobacillus*, *Citrobacter*, coliform bacteria, *Saccharomyces*, *Penicillium* and *Rhizopus*[1,2,7-9].

Although, 'ogiri' has a pleasant aroma when added to soups and sauces; it is however, noted that its shelf-life is short. Moreover, poor packing material produce putrid odor and stickiness. Therefore, the aim of this study was to compare the acceptability of the wet, micro-waved and dry 'ogiri' when used to prepare soup.

MATERIALS AND METHODS

Sample collection and preparation: Samples of the well wrapped vended 'ogiri' were randomly bought from Choba market in Port Harcourt, Rivers State, Nigeria. Samples were aseptically transported to the laboratory for analysis. The purchased 'ogiri' sample was divided into three portions. One portion was dried at 100°C for 1 h in a hot air oven. A second portion was micro-waved for 1 h, while the third portion was kept in the refrigerator for further analysis.

Proximate analysis: Proximate composition of the wet, oven dried and micro-waved 'ogiri' samples were determined using the method of Association of Official Analytical Chemists[10]. Samples were analyzed for moisture, ash, fat, protein, crude fibre and carbohydrate.

Microbiological analysis: A total of 25 g of each of the wet, oven dried and micro-waved samples were transferred to separate 250 mL of sterile normal saline followed by ten-fold serial dilution and spread plating of appropriate dilutions on Nutrient and Eosin methylene blue agar. Seeded plates were incubated at room temperature (29±2°C) for 24 h. Distinct colonies were purified on freshly prepared Nutrient agar. Pure cultures of isolates were stored on nutrient agar slants in a refrigerator at 4°C for further characterization.

Characterization of isolates: The isolated bacteria were identified conventionally on the bases of the cultural morphology, physiological and biochemical characteristics and compared with Bergey's Manual of Determinative Bacteriology[11].

Sensory evaluation of soup: Sensory evaluation of bitter leaf soup, prepared separately with wet, oven dried and micro-waved 'ogiri' was carried out using randomly selected 10-man panelists. Some of the panelists were used to eating delicacies prepared with 'ogiri'. Hence were used to assess the sensory attribute (aroma, taste, colour, appearance and overall acceptability). The panelists were instructed to rate the sample for the parameters based on a 9-point hedonic scale ranging from 9- liked extremely to 1-disliked extremely. The raw scores were collected and statistically analyzed.

RESULTS AND DISCUSSION

The proximate composition of the wet, oven dried and micro-waved 'ogiri' is presented in Table 1. The proximate analysis of the wet 'ogiri' samples revealed the composition of moisture (40.01%), ash (3.28%), carbohydrate (0.89%), protein (14.11%), lipid (40.02%) and fibre (1.69%). The proximate composition of wet 'ogiri' from castor oil seed is not available in the published literature except, the fat content (40.53%) reported by Ogbuonye[12] which is comparable to 40.02% in the present study. However, the proximate composition of wet 'ogiri' produced from different melon species [*Cucumeropsis manii* (Naud); *Citrullus lanatus* L. and *Colocynthis vulgaris* (Schrad)] and kersting groundnut seeds (*Macrotyloma geacarpum*) is available in the litereture. The protein (14.11%)

Table 1: Percentage proximate composition of wet, oven dried and micro-waved 'ogiri.'

Sample	Moisture	Ash	CHO	Protein	Lipid	Fibre
Wet	40.01	3.28	0.89	14.11	40.02	1.69
Oven dried	4.10	2.00	1.21	13.12	64.95	14.62
Micro-waved	1.20	4.40	1.47	16.62	70.58	5.73

CHO: Carbohydrate

Table 2: Mean scores for the sensory quality parameters of the wet, micro-waved and oven dried 'ogiri.'

Sample	Taste	Aroma	Mouth feel	Appearance	Colour	Overall acceptability
Wet 'ogiri'	3.9±1.9[a]	4.9±2.1[a]	4.3±1.6[a]	5.5±0.71[a]	7.1±1.2[a]	4.9±1.7[a]
Oven-dried 'ogiri'	7.3±1.1[b]	6.6±1.6[b]	7.1±2.0[b]	6.7±0.48[b]	7.4±1.2[a]	7.3±0.8[b]
Micro-waved 'ogiri'	7.5±1.4[b]	7.3±1.5[b]	7.2±0.9[b]	6.8±0.79[b]	7.6±0.8[a]	7.6±1.0[b]

Values in table-represent means and standard deviation from 10 respondents. [abc]Means with the same superscript within the same column are not significantly different ($p>0.05$)

and carbohydrate (0.89%) contents of wet 'ogiri' from castor oil seeds were not comparable to the protein (24.60±0.3 to 32.00±1.5%) and carbohydrate (19. 00±0.0 to 25.20±1.3%) contents of wet 'ogiri' from the melon and kersting groundnut seed[12,13]. The lipid (40.02%), fibre (1.69%), ash (3.28%) and moisture content (40.01%) of wet 'ogiri' found in this study were comparable with the findings of previous studies by Ogbuonye[12], David and Aderibigbe[13] who reported the lipid (10.00±0.0 to 43.20±2.1%), fibre (1.94±0.1 to 4.00±0.0%), ash (2.92±0.7 to 4.80±0.0%) and moisture contents (33.40±0.4 to 38.30±1.3%).

The oven dried 'ogiri' sample had the moisture (4.10%), ash (2.00%), carbohydrate (1.21%), protein (13.12%), lipid (64.95%) and fibre (14.62%) contents while the micro-waved sample had moisture (1.20%), ash (4.40%), carbohydrate (1.47%), protein (16.62%), lipid (70.58%) and fibre (5.73%) contents. The values for moisture (5.8%) and ash (2.1%) content of the oven dried samples are similar to a previous study conducted by Ibeabuchi *et al.*[14] for dry 'ogiri' prepared from castor oil seeds. In oven dried and micro-waved 'ogiri' sample the lipid content (64.95%, 70.58%) obtained in the present study were higher than those reported by Ibeabuchi *et al.*[14] which was (40.53%); protein contents (13.12%, 16.62%), obtained in the present study were lower than those reported by Ibeabuchi *et al.*[14] which was 18.10%; fibre contents (14.62%, 5.73%) obtained in the present study were lower than those reported by Ibeabuchi *et al.*[14] which was 23.30%; carbohydrate contents (1.21%, 1.47%) were lower than those reported by Ibeabuchi *et al.*[14] which was 10.08%. However, it was observed that 'ogiri' improved the nutrient contents of soups.

The microbial counts of the wet 'ogiri' samples ranged from 9.7×10^4 to 3.2×10^6 CFU g^{-1}, while the oven dried and micro-waved samples had non-significant growth. The low counts observed with the oven dried and micro-waved samples may not be unconnected with the fact that the identified bacteria were mesophiles, which could be destroyed at cooking temperature, with the exception of the spores. The microbial counts of the wet 'ogiri' samples from castor oil seeds and melon seeds were less than those reported by Ibeabuchi *et al.*[9] (3.07×10^{12} CFU g^{-1}) Barber *et al.*[8] (1.7×10^{11} CFU g^{-1}) and David and Aderibigbe[13] (2.12×10^8 to 2.10×10^{10} CFU g^{-1}) but comparable to the results of previous study conducted by Ogbuonye[12] who reported that the microbial counts of the wet 'ogiri' samples produced from kersting groundnut seed ranged from 2.70×10^5 to 7.7×10^5 CFU g^{-1}.

The bacteria genera identified on the basis of their cultural morphology, physiological and biochemical characteristics were: *Bacillus* (32%), Proteus (16%), *Pseudomonas* (26%), *Staphylococcus* (10%), Micrococcus (11%) and *Lactobacillus* (5%). This finding is consistent with previous reports on the isolated genera and the predominance of *Bacillus* species 'ogiri' produced from different substrates[1,2,7-9,12,15].

The colour of the wet 'ogiri' was changed from milky gray to dark gray after heating. The colour of dried and micro-waved samples were preferred to the wet sample. In terms of aroma, the micro-waved sample was the most preferred. The results of sensory analysis of soup prepared with the wet, micro-waved and oven dried 'ogiri' are presented in Table 2. In terms of the overall acceptability, there was no significant difference ($p<0.05$) between the bitter leaf soup prepared with the micro-waved and oven dried 'ogiri.' This also applies to all the parameters. However, a significant difference was observed between the bitter leaf soups prepared with the wet 'ogiri.' The panelist preferred the bitter leaf soup prepared with the micro-waved 'ogiri' sample.

CONCLUSION

The findings of this study have shown that the dried 'ogiri' samples had longer shelf-life due to its lower moisture content, reduced microbial load and absence of the putrid

odour and stickiness associated with the wet 'ogiri.' More importantly, soups prepared with the 'ogiri' samples showed that the micro-waved sample had the highest overall acceptability, followed by the oven-dried sample and lastly the wet samples.

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