

Comparative study of proximate and sensory qualities of iru powder, ogiri powder and iru-ogiri blend

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ABSTRACT

“Iru powder” and “Ogiri-isi powder” were produced from African locust bean (*Parkia biglobosa*) and Castor oil seed (*Ricinus communis*) respectively, using traditional method. Raw samples were dehulled, boiled and fermented for 96hrs, dried and packaged. Commercial “ogiri” samples bought from market were used as controls. The “iru powder” and “ogiri-isi” were comparatively evaluated with the local commercial ogiri based on the sensory properties. The proximate compositions of the “iru” and “ogiri-isi” were compared with those of raw locust bean and castor oil seeds. The pH changes occurring during the fermentation of the seeds were monitored. The pH increased with the fermentation period, ranging from 6.38 to 7.2 in locust bean and 6.36 to 7.15 in castor seed within the 96hrs. The fermentation had effect on the proximate composition of the seeds. The crude protein increased from 32.4% to 39.5% in locust bean and 14.07% to 18.1% in castor seed. The proximate values of ether extract and moisture increased during fermentation, while ash, crude fibre and carbohydrates decreased in both seeds. The sensory evaluation scores showed significant difference at ($P < 0.05$) between the condiments produced and the commercial ogiri samples. © 2013 Trade Science Inc. - INDIA

INTRODUCTION

‘Iru’ and ‘Ogiri’ are the two most popular indigenous fermented condiments produced from legumes and oil seeds^[17]. ‘Iru’ is the Yoruba name for the fermented condiment produced from African locust bean (*Parkia biglobosa*)^[15]. It is also known as ‘dawadawa’ in Hausaland and by different names among ethnic groups.

‘Ogiri’ is the name used by Igbos for the traditionally prepared fermented condiments based on vegetable proteins. It is obtained by fermenting melon seeds (*Citrullus vulgaris*), fluted pumpkin (*Telferia occidentalis*) and castor oil seeds (*Ricinus Communis*)^[12]. These raw materials are used to create the different varieties of ‘Ogiri’ such as ‘Ogiri-egusi’, ‘Ogiri-ugu’, ‘Ogiri-’isi’ and ‘Okpiye’^[1].

The bulk of the indigenous fermented condiments of Nigeria are found in the Southern states of Nigeria. Interstate trade and relocation has however, widened the scope of the spread throughout the country and beyond^[9]. ‘Iru’ and ‘Ogiri’ have played major roles in the food habits of communities in the rural regions serving not only as a nutritious non-meat protein substitute but also as condiments and flavouring agents in soups and sauces^[1]. They have potential good uses as protein supplement and as a functional ingredient. Soups are the main sources of protein and minerals and one of the ways to improve the diet is to improve the nutrient content of soups. According to Steinkrans, the traditional fermented foods contain high nutritive value, better digestibility and developed a diversity of flavours, aroma and texture in food substrates. In addition ‘iru’ and ‘ogiri’ contribute protein, minerals and calories in the diets^[3].

Legumes and oil seeds are fermented by allowing the various microorganisms to act on them through enzymatic activity to yield condiments by the extensive hydrolysis of carbohydrate and protein components^[6,7]. Apart from reduction in the anti-nutritional factors, fermentation markedly improved the digestibility, nutritive value and flavours of the raw seeds^[14,20].

Although 'iru' and 'ogiri' condiments constituted significant proportion of the diet of many people, they are associated with some problems such as having a short shelf life, objectional packaging material, the characteristic putrid odour and stickiness^[5]. The production of condiments is largely on a traditional small-scale, household basis under highly variable conditions^[14]. In addition, the fermentation is usually carried out in a moist solid state, involving contact with appropriate inocula of assorted microorganisms and is accomplished by the natural temperatures of the tropics.

It is envisaged that the production of 'iru' in powder form and blending together the ogiri and 'iru' are introduction of the old popular traditional seasoning product in the more convenient form, better suited to compete with the other forms of soup condiments like magi cubes (Monosodium glutamate based salts) which is not consumed by many people because of its health related problems.

It is reported that the development of off-flavour is due to protease activity which could be controlled by terminating enzyme activity at the end of fermentation^[1,10]. Therefore, controlled fermentation and drying processes will certainly check the strong offensive odour, which results from continued microbial activities in the present commercial ogiri product at storage. This in turn will help to improve the acceptance of the product by youths and the modern society.

MATERIALS AND METHODS

The African locust bean (*Parkia biglobosa*) and castor and seed (*Ricinus communis*) used in this study were bought from a local market at Nsukka, Enugu State and Ngodo, Umunneochi L.G.A, Abia State respectively.

The reagents and equipments employed in the process of production and analysis of the products-'Iru' and 'Ogiri' were obtained from the laboratory of the

Department of Food Science and Technology, Federal University of Technology, Owerri and Dr. Wesley Braide Laboratory, Nekede, Owerri.

PROXIMATE ANALYSIS

Proximate composition (moisture, ash, fat, protein, crude fibre and carbohydrate) of the raw and fermented African locust bean (*Parkia biglobosa*) and castor oil seeds (*Ricinus communis*) was determined using the method of Association of Official Analytical Chemists^[4].

Moisture content determination

Two grams (2g) of each sample was weighed into a dried crucible of known weight, fed into the oven at 105°C for 3h, withdrawn into a dessicator to cool, weighed, then reheated, cooled and reweighed, and reheated. The process was repeated until relatively constant weight was realized. The difference in the weights before and after drying was recorded as moisture content. The moisture content was calculated using the formula.

$$\% \text{ Moisture content} = \frac{W_2 - W_3}{W_2 - W_1} \times 100$$

Where W_1 = Weight of crucible; W_2 = Weight of crucible + sample before drying; W_3 = Weight of crucible + sample after drying

Ash content determination

After moisture content determination, the dried samples were transferred into the muffle furnace, ignited heat at 55°C until they were carbonized and calcinated until black particles were no more. The samples were withdraw and cooled in a dessicator, then the weight of the residual incinerate was calculated as ash content. The percentage ash was calculated as following

$$\% \text{ Ash} = \frac{W_2 - W_3}{W_1} \times 100$$

Where W_1 = Weight of sample before ashing (g); W_2 = Weight of dish + sample after ashing; W_3 = Weight of empty dish

Crude fat (ether extract) determination

Two grams (2g) of sample was wrapped in a filter paper and gradually lowered in the thimble which was

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fitted to a flask containing the solvent, n-hexane. The round-bottomed flask, in a soxhlet extraction unit was slowly heated with thermostically controlled mantle, during which the solvent evaporated and passed through the sides tube of the extract to the reflux condenser where it condensed and ran back into the samples dissolved in the n-hexane and the mixture of the hexane and fat.

The filter paper with the spent (defatted sample) were removed from the extractor and the refluxed solvent distilled out and recovered. The flask containing the fact and residual solvent was dried at 85°C for 3h, cooled and weighed. The difference in weight was recorded as crude fat was calculated as follows.

$$\% \text{ Crude fat} = \frac{W_2 - W_1}{S} \times 100$$

Where W_1 = Weight of empty evaporating dish; W_2 = Weight of evaporating dish + content after drying; S = Weight of sample after drying.

Crude protein determination

2 grams of samples, 0.10g CuSO_4 and 2.50 Na_2SO_4 were put into a micro Kjeldahl flasks, followed with addition of 20ml concentrated H_2SO_4 solution together with anti-bumping clips. The flasks were heated using heating mantle in the unit until initial black colour formed turned to light green. The flasks, covered (plugged) with cotton wool were cooled prior to distillation. After cooling the digest was mounted on the distillation apparatus which the distillation arm was connected such that the condenser's tip was below the surface of a 20ml of 2% boric acid solution in conical flask. Using funnel, 35ml of 40% NaOH and 80ml of distilled water were added into the digest flask. The contents of the flask were distilled until 30ml of distillate were obtained after about 15min. to this was added 2 drops of methyl-red indicator and titrated with 0.1NHCL solution to a pink end point. A blank test was carried out by repeating the processes of digestion, distillation and titration without the presence or involvement of the test raw and fermented samples in order to give a blank value for any trace of nitrogen that may be present in the reagent and handling material (analytical chemicals/media). The crude protein was subsequently calculated thus:

$$\% \text{ crude protein} = \frac{((V_1 - V_b) \times N_a \times 0.00014 \times 6.25 \times V_D)}{(V_{AL} \times M_s)}$$

Where V_1 = Titre value for the samples distillate, V_b = Titre value for the blank distillate, V_D = Distillate volume obtained; V_{AL} = Aliquot of the distillate taken for titration; N_a = Normality of acid used (HCL) 0.00014 = Conversion constant for % N_2 ; 6.25 = Conversion constant from % N_2 to % protein.

Crude fibre determination

Two grams (2g) of sample was weighed and placed in a hot 200ml of 1.25% H_2SO_4 and boiled for 230mins. It was then filtered through a buckner funnel equipped with muslin cloth and held with elastic band. The funnel was made hot by pouring boiling water on to it. The residue was washed thrice with hot water, scooped into a conical flask, digested with 200ml of 1.25% NaOH solution for 30mins boiling. It was filtered and progressively washed with boiling water, 1% Hcl and boiling water to remove acid from it. The residue was washed twice with alcohol and three times with petroleum ether using small quantities. The residue was scooped into a clean, dry and weighed porcelain crucible, dried in the oven at 85°C to a constant mass. It was then cooled and weighed. The crucible with its content was placed inside muffle furnace at 600°C for 2h, withdrawn, cooled in dessicator and weighed. The difference in mass is calculated and reported as crude fibre.

$$\% \text{ Crude fibre} = \frac{M_3 - M_4}{M_2 - M_1} \times 100$$

Where M_1 = Mass of crucible; M_2 = Mass of sample + crucible; M_3 = Mass of crucible + residue after drying; M_4 = Mass of crucible + ash after incineration;

Carbohydrate content determination

Carbohydrate content was calculated as Nitrogen Free Extract (NFE), determined by the difference obtained by subtracting the values of all the nutrients measured from 100 as follows:

$$\% \text{ NFE} = 100 - (\% \text{ moisture} + \% \text{ protein} + \% \text{ fat} + \% \text{ crude fibre} + \% \text{ Ash})$$

pH Determination 2g of sample was weighed and suspended in 50ml of distilled water and mix thoroughly. The pH was measured by inserting the pH probe in the solution.

Sensory evaluation of the 'iru' and ogiri in soup sampels

Sensory evaluation was carried out using eleven

taste panelists to assess the sensory attribute (colour, aroma, taste, texture and overall acceptability) of the produced food condiments (iru and ogiri-iru blend). The soups prepared with the 'iru' and 'ogiri-iru blend' seasonings were presented to the panellists, using the soup prepared with commercial 'ogiri' as a reference. The panellists were selected randomly cutting across students and workers of the university community which include people who are used to eating 'iru' and 'ogiri' and those who are not used to them. The samples were presented in coded identical plates. The panellists are instructed to rate the sample for the parameters based on a 7-point hedonic scale ranging from 7-liked extremely to 1-disliked extremely. The raw scores were assembled and statistically analyze using the method described by Ihekoronye and Ngoddy^[8].

Statistical analysis

Data obtained from the study of the sensory evaluation was subjected to analysis of variance (ANOVA) and the means were separated using Fisher LSD and judged significantly different at 95% confidence level (i.e $P < 0.05$).

RESULTS AND DISCUSSION

Proximate composition of raw and fermented African locust bean (*Parkia biglobosa*) and castor oil seed (*Ricinus communis*) are shown in TABLE 2. The moisture content of raw African and castor bean oil seed was 1.20% and 2.1% respectively. This was determined on the dried materials. There was an increase in the moisture content of fermented African locust bean and castor oil seed, which was 11.3% and 5.8% for both samples respectively as a result of boiling in water followed by further soaking in water in the case of African locust beans.

The ash content of raw African and castor oil seed was 5.3% and 7.7% respectively. The value reported

for African locust bean agreed favourably with 5.1% reported earlier by Eka^[6]. Boiling, soaking in water and dehulling of African locust bean led to a loss of 40% ash. This means that about 40% of the total mineral content of African locust bean may reside in the hull of the seed and or leached during processing. The ash content of fermented African locust bean and castor oil seed were 2.39% and 2.1% respectively. Fermentation seemed to have decreased the ash content of both seeds which agrees with the observation of Eka^[6]. Therefore, boiling and fermentation of Africa locust bean and castor oil seed seem to have effect on the ash content.

The fat content of raw African locust bean seed and castor oil seed was 15.5% and 35.0% respectively, while the fermented seeds have 17.3% and 40.53% respectively. This means that fermentation led to increase in fat content for both African locust bean and castor oil seed (TABLE 1). This shows that lipase activity is low in fermenting African locust bean, while the raw bean contains 17.7% to 21% fat as reported by Odunfa^[14].

The protein content was 32.4% and 14.07% for raw African locust bean and castor oil seed respectively. Fermentation also led to increase in protein content for both seeds, which was 39.5% and 18.1%. The crude protein reported for African locust bean agreed favourably with 30.6% reported earlier by Eka^[6], while that of castor oil seed was close to the 16.9% value reported for another sample of castor oil seed by Adewusi *et. al.* The increase in crude protein with fermentation process of the seeds was probably due to the reduction in the content of ash, crude fibre and carbohydrate (TABLE 1).

The crude fibre content of 9.6% and 6.2% are now reported for raw African locust bean and castor oil seed respectively (TABLE 1); these values were higher than the 3.6% value reported for cowpea^[16]; 0.2% crude but close to the 8.8% value reported for African locust

TABLE 1 : Means scores for the sensory quality parameters of freshly produced iru and ogiri samples

Samples	Colour	Aroma	Taste	Texture	Overall acceptability
Iru powder	5.4 ± 1.15 ^b	5.8 ± 0.3 ^a	6.1 ± 0.67 ^a	5.0 ± 1.75 ^b	5.3 ± 1.05 ^b
Ogiri- isi powder	5.8 ± 0.08 ^a	5.2 ± 0.32 ^b	5.9 ± 0.22 ^a	6.04 ± 0.12 ^a	5.42 ± 0.06 ^b
Ogiri-Iru Blend	6.0 ± 0.60 ^a	5.5 ± 1.50 ^a	6.4 ± 0.48 ^a	5.71 ± 0.05 ^a	6.1 ± 0.67 ^a
Commercial ogiri	3.2 ± 1.19 ^c	2.5 ± 0.78 ^c	5.1 ± 1.98 ^b	3.1 ± 1.44 ^c	4.5 ± 1.88 ^{ab}

^{abc}... Means with the same superscript within the same column are not significantly different ($P \geq 0.05$)

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TABLE 2 : Proximate composition of raw and fermented African locust bean and castor oil seed (% dry sample)

Sample	Moisture (%)	Ash (%)	Fat (%)	Crude protein (%)	Crude fibre (%)	Carbohydrate (%)
Raw ALB	1.2	5.3	15.5	32.4	9.6	36.0
Iru	11.31	2.39	17.3	39.5	7.4	23.02
Raw COS	2.1	7.7	35.	14.07	24.2	16.3
Ogiri- isi	5.8	2.1	40.53	18.1	23.3	10.08

Key: ALB = African locust bean; COS = Castor oil seed

bean seed by Oyenuga^[9]. Boiling, dehulling and fermentation of African locust bean seed reduced the crude fibre.

Based on these results, the fermentation resulted in extensive hydrolysis of carbohydrate and protein components which agrees with the observation of Fetuga, *et al.*,^[7] and Eka^[6].

Fermentation of both African locust bean and castor oil seed samples led to increase in pH (TABLE 3) as earlier observed by Odunfa^[12]. The pH increased with fermentation period, ranging from 6.38 to 7.2 in locust bean and 6.36 to 7.15 in castor seed within the 96hrs.

TABLE 3 : Mean pH values of fermenting seeds at different fermentation periods

Periods of fermentation (hours)	'iru' from African locust bean	'Ogiri' from Castor oil Seed
0	6.38	6.36
24	6.31	6.37
48	6.48	6.42
72	6.76	6.81
96	7.20	7.15

ALB= African locust bean; COS= Castor oil seed

The trend of pH increase during fermentation agrees favourably with the earlier studies carried out on 'ogiri' fermentation. Similarly other works on similar seeds, like fermentation of melon seed (*Citrullus vulgaris*) by Odunfa^[11] reported increase in pH. Njoku *et al.*^[10] reported a pH increase from 6.7 to 8.4 during African oil bean (*Pentaclethra macrophylla*) seed fermentation. Ogunsanwo *et al.* observed an increase in pH of mash from 6.2 to 7.2 during "egusi" fermentation. The higher pH values of fermented legumes and oil seeds compared to other materials under similar conditions have been attributed to higher protein contents of these seeds. Achinewhu reported that during the fermentation of 'egusi' the total of unsaturated fatty acids in-

creased with hydrolysis of protein into amino acids and peptides. Ammonia is released raising the pH of the final products and giving the food a strong ammonical odour and flavour. Wang and Fung refereed such fermentations as "alkaline fermentation" and this aids in prolonging shelf life of such products.

TABLE 1 shows the mean values of sensory parameters of freshly produced 'iru' powder, ogiri-iru blend and commercial ogiri products used in parparing the ogbono soup. There was no significant difference ($P > 0.05$) between the iru and ogiri-iru blend soups in their colour, aroma, taste and testure, their real numerical scores were liked moderately, while they disliked slightly the colour and texture, and disliked moderately the aroma of the commercial ogiri product. On the overall acceptability, there was significant different ($P < 0.05$) between the iru, ogiri-iru blend and commercial ogiri products. The ogiri-iru blend soup has the highest in the overall acceptability.

Generally, in all quality parameters considered, the iru and ogiri-iru blend scored higher than the commercial ogiri. Therefore, the panellists preferred the produced food condiments to the present commercial ogiri product in the local markets.

CONCLUSION AND RECOMMENDATION

The results of this study have shown that fermentation of African locust bean and castor oil seed to produce 'iru' and 'ogiri-isi' respectively increases the crude protein and fat content of the products. The liberal use of these condiments is expected to increase the intake of these essential dietary components appreciable. In addition, the production 'iru' in powder form and blending together the 'ogiri' and 'iru' as flavouring ingredients could be more acceptable than the way they are sold in the market and an added advantage over seasoning salts, which now tend to replace the local condi-

ment in our kitchens.

This work has succeeded in producing iru powder and ogiri-iru blend which was organoleptically acceptable. In the organoleptic evaluation scores of the products, there was significant different ($P < 0.05$) between the produced condiments and the commercial sample in their sensory parameters with exception of flavour. The work has also indicated the possibility of up-grading 'iru' and 'ogiri' production to a cottage industry. However, the ease of production is more with castor oil seed (*Ricinus communis*) than the African locust bean (*Parkia biglobosa*) which is not as commonly available as the castor seed. Moreso, the dehulling of African locust bean is difficult and need to be mechanized.

Further work that could be carried out on this study is to use pure culture microorganisms in the fermentation process and observe the effects on the end product. The starter culture could be commercially developed like that used for yoghurt production.

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