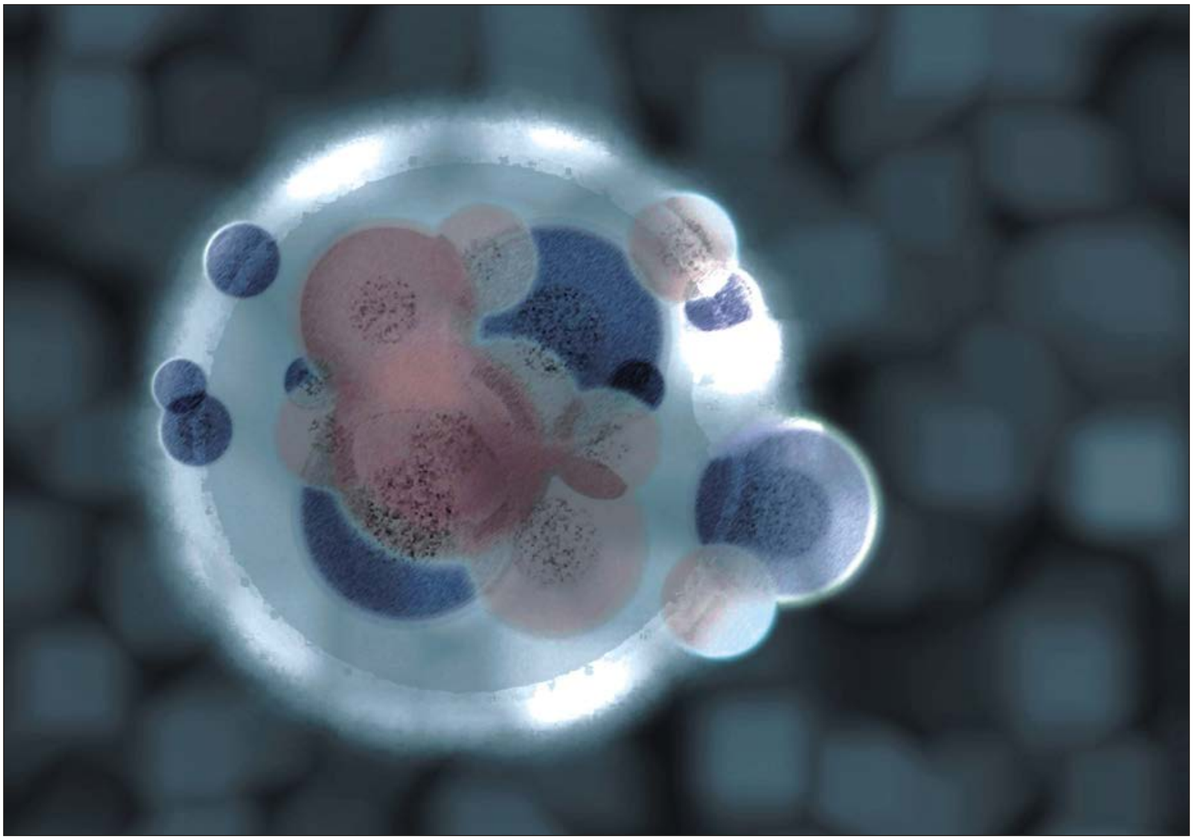

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Production of Soy-iru Using an Alternative Method of Processing and Fermenting Container

[1]E.O. Farinde, [1]S.B. Fasoyiro, [1]V.A. Obatolu and [2]A.A. Yusuf
[1]Institute of Agricultural Research and Training, Obafemi Awolowo University, Moor Plantation, P.M.B. 5029, Ibadan, Nigeria
[2]Federal College of Animal Health and Production Technology, I.A.R. and T., Moor Plantation Ibadan, Nigeria

Abstract: Soybean (*Glycine max*) was processed into iru using two types of processing methods and two types of fermenting containers. The processing methods used were boiling and roasting while the fermenting containers were calabash and plastic. The processed soy-iru were analysed for proximate composition, mineral content, pH and titratable acidity. The microbial load was also determined. The samples were calculated for sensory qualities. The moisture content of the samples ranged from 11.64 to 12.57%. The crude protein ranged from 36.13 to 39.41%, fat 22.40 to 26.80%, crude fibre 4.56 to 6.24%, carbohydrate 13.20 to 17.24%, ash 3.50 to 3.71%. The pH of the samples ranged from 7.98 to 8.68 and the titratable acidity ranged from 0.60 to 0.69. The amount of calcium in the samples range within 444 to 573 mg/100 g, phosphorus 310 to 349 mg/100 g, magnesium 150 to 290 mg/100 g and iron 9 to 11 mg/100 g dry matter. The microorganisms present were those associated with fermentation, Lactic acid bacteria and *Bacillus* sp. The total viable count in the four samples ranged from 6.08 to 8.12 expressed as log 10 cfu g^{-1}. All the iru samples were acceptable by the sensory panelists but the Roasted Cooked Fermented in Calabash (RCFC) was the most preferred.

Key words: Soy-iru, fermentation, calabash, plastic container

INTRODUCTION

Soy-iru (Soy-dadawa) is a food flavouring condiment prepared by fermenting whole soybean. It is widely consumed by the people of Benue and Plateau States of Nigeria and its consumption is now extending to the southern part of Nigeria. Pederson (1971) describe fermentation as a complex chemical transformation of organic substances brought about by the catalytic action of enzymes either originally present or secreted extracellularly by the microorganisms fermenting the material. The microbiology of fermentation and some biochemical changes occurring during the production of this condiment have been reviewed (Odunfa, 1985).

Locus beans have been the traditional raw material for the production of iru (dadawa). Dadawa enhances good taste and also serve as a low cost protein source in diet of low income families (Odunfa, 1986). However, emphasis is been shifted to the use of soybean (*Glycine max*) as a substitute. Some reasons why soybean should substitute locust bean have been reviewed (Oyeleke, 1984) among which are:

- There is a consistence reduction in the number of parkia trees as a result of land clearing for mechanized farming.
- The tree needs several years to mature.
- Separating seed from the pulp could be time consuming.
- Cotyledons take too long to cook.
- Decorticating seeds is laborious and a lot of nutrient is lost in the process.
- Soybean appears to have higher nutrient than locust bean.

Chemical studies have been carried out to know the nutritive value of soy-iru, according to (Omafuvbe *et al*., 2002), fermented soybean has the following chemical composition as expressed by 100 g dry matter, crude protein 49.51, fat 31.46, crude fibre 3.49, ash 3.97, carbohydrate 15.06 and organic matter 96.03. It also contains appreciable amount of minerals.

The preparation of both soybean and locust bean condiments involve the natural fermentation of dehusked cooked seeds (Odunfa, 1985; Abiose *et al*., 1988;

Corresponding Author: E.O. Farinde, Institute of Agricultural Research and Training, Obafemi Awolowo University, Moor Plantation, P.M.B. 5029, Ibadan, Nigeria Tel: 2348033618883

Barber and Achinewu, 1992). The traditional method of preparing soy-iru has been described (Omafuvbe *et al*., 2002). The product from such fermentation is sticky with a strong ammoniacal smell (Ogbadu and Okagbue, 1988).

With the literature available, effect of different processing method on the qualities of soy-iru has not been fully documented. Omafuvbe (1994) reported the effect of added salt on the soy-dadawa and found that the microbial growth, pH and titratable acidity decreased with increasing sodium chloride concentration during soybean fermentation. Traditionally soy-iru is processed by boiling the soybean seeds in water, followed by dehulling, cooking in boiling water and fermenting in calabash. The traditional fermenting container, calabash is now getting into extinction, hence there is need for an alternative such as plastic. Roasting method is also an alternative method of processing to the traditional boiling method.

This study investigated the effect of two types of processing methods using two types of fermenting containers on the microbiological, chemical and organoleptic acceptability of the product (Soy-iru).

MATERIALS AND METHODS

Source of materials: Soybean (*Glycine max*) of variety TGX 1740 was obtained from Institute of Agricultural Research and Training, Ibadan, Nigeria. The plastics and calabashes used were purchased from Oje market in Ibadan, Nigeria.

Processing of soybean for fermentation: One kilogramme of clean soybean seeds was divided into two portions, 500 g each. One portion was roasted in a dry pan for 10 min. The seed coats were removed by rubbing between palms and winnowed. The dehulled beans were cooked in boiling water for 2 h on electric stove. Cooking water was allowed to dry on the beans before removing the heater to retain the nutrient. The other portion was blanched and cooked again for 2.5 h, cooking water was also allowed to dry on the seeds before removing the heater.

Fermentation process: The roasted and cooked portion was divided into two portions. One part was poured hot into a calabash already lined with clean banana leaves coded as RCFC while the other part was poured inside a plastic container coded as RCFP. They were both covered with airtight calabash and plastic covers respectively. The containers were wrapped properly with cloth and placed in a warm place to ferment for 72 h. The boiled and cooked portion was also divided into two portions. One part was also poured in a calabash coded as BCFC and the other portion was poured in plastic container coded as BCFP. They were fermented using the same procedure as above.

Storage: The fermented samples were dried in an oven at 60°C for 24 h. Dried samples were grinded into powder and stored in a screw cap bottles for subsequent analysis.

Procedure analysis: The moisture, crude protein, fat, crude fibre and ash were determined using the method AOAC (1990). Carbohydrate was calculated by difference (Egan *et al*., 1981).

Determination of minerals: The mineral composition of the samples was also determined using the method (AOAC, 1990).

Determination of pH and titratable acidity: The pH and titratable acidity were determined using the method (Ikenebomeh, 1989).

Microbial determination (Viable count): Five gram of the freshly prepared iru samples (wet) was weighed into a flask containing 50 mL of sterile 0.1% peptone water. The mixture was shaken properly. One milliliter of the dilution was pipette into a sterile test tube containing 9 mL of 0.1% peptone water. The process was repeated for each of a set of nine tubes until a 10^{-10} dilution was achieved. One millilitre from the last two dilutions was plated in duplicate on nutrient agar for total bacteria count, manderogosa shape medium (MRS) for the growth of *Lactic* acid bacteria and *Bacillus* sp., manitol salt agar for the growth of *Staphylococcus* and potato dextrose agar for the growth of fungi. The plates were incubated at 35°C for 48 h after which the bacteria colony were counted.

Sensory evaluation: Freshly prepared iru samples using the four processing methods were presented to 10 panelists for assessment. The samples were scored for colour, appearance, flavour, texture, taste and overall acceptability using the nine hedonic scale where 9 = like extremely and 1 = Dislike extremely.

Statistical analysis: The results were analysed using Analysis of Variance separated by Duncan Multiple Range Test using SAS (1985).

RESULTS AND DISCUSSION

The proximate composition of the iru samples are shown in Table 1. The moisture content of all the four samples ranged from 11.64 to 12.57%. All the four samples recorded high protein content within the range of

Table 1: Proximate analysis of soy-iru samples

Sample code	Moisture (%)	Protein (%)	Ether extract (%)	Crude fibre (%)	Carbohydrate (%)	Ash (%)
BCFC	11.64a	36.80ab	26.71b	5.35a	16.00a	3.50a
BCFP	12.57a	36.13ab	22.40a	6.24a	17.24a	4.42a
RCFC	11.94a	39.41a	26.80b	5.15b	13.20c	3.50a
RCFP	11.89a	38.50b	25.00b	4.50a	16.20a	3.71a

Each value represent mean of three replicates. Mean of each value followed by the same letter(s) within the same column are not significant different at $p<0.05$

Table 2: Mineral content of the soy-iru

Sample code	Calcium	Phosphorus	Iron	Magnesium
BCFC	452	310	11.0	284
BCFP	461	322	9.0	290
RCFC	444	444	10.5	150
RCFP	573	322	10.5	263

Each value represent mean of two readings. Elements are expressed as mg/100 g dry matter

Table 3: pH and titratable acidity of soy-iru

Sample processing code	pH	Titratable acidity (mg lactic acid g^{-1})
BCFC	8.08	0.60
BCFP	7.98	0.64
RCFC	8.68	0.61
RCFP	8.14	0.69

Table 4: Microbial count of soy-iru samples

Sample Code	Total viable count	Lactic acid bacteria	*Bacillus* sp.	Staphylococcus	Fungal
BCFC	6.08	3.42	3.02	1.1	Nil
BCFP	8.60	3.10	3.12	1.1	Nil
RCFC	6.25	2.08	3.01	-	Nil
RCFP	8.12	4.50	3.25	-	Nil

Value expressed as $\log_{10}$ cfu g^{-1} wet weight

Table 5: Sensory evaluation of soy-iru samples

Sample code	Colour	Appearance	Flavpur	Texture	Taste	Overall acceptability
BCFC	6.5a	6.0c	5.8a	6.4b	6.6a	7.7a
BCFP	5.5a	5.5c	5.1a	5.2b	5.6a	7.1a
RCFC	9.2b	8.4a	8.5a	7.0b	7.5a	7.9a
RCFP	8.6b	8.0a	8.0a	6.1b	7.1a	7.5a

Mean of each attribute followed by the same letter(s) within the same column are not significantly different at $p<0.05$. Higher value indicated greater preference

36.13 to 39.41%. Similar high value of protein content in fermented soybean has been reported (Omafuvbe *et al*., 2002). The protein content of RCFC is significantly higher ($p<0.05$) than all the other iru samples, it recorded the highest protein content of 39.41%; this showed that much protein is not lost in the process of roasting and fermenting in calabash. The fat content of the four iru samples ranged within 22.40 to 26.80%. There was no significant difference ($p<0.05$) in the fat content of BCFC and RCFC and they both recorded the highest fat content. This might imply that the fatty acids formed during fermentation are much conserved when the soybean was fermented in calabash than in plastic. The carbohydrate content of all the iru samples were within the range of 13.20 and 17.24%. The range in carbohydrate content of the iru samples are similar to those already reported in both locust bean and soybean dadawa (Omafuvbe, *et al*., 2002; Eka, 1980; Sarkar *et al*., 1994). There was no significant difference ($p<0.05$) in the crude fibre of BCFC, BCFP and RCFP. There was also no significant difference in the ash of all the samples.

The mineral contents of the iru samples are shown in Table 2. Soybean is not a major source of mineral but the mineral content of the soy-iru samples were still within the range reported by Odunfa (1985).

The pH and titratable acidity of the iru samples fall within the alkaline pH range of 7 and 8, they still fall within the normal pH range of soy dadawa (Omafuvbe *et al*., 2000). The increase in pH towards alkalinity is probably due to proteolysis and release of ammonia following the utilization of amino acids by fermenting microorganisms. (Table 3). The release of ammonia is responsible for the ammoniacal odour characteristic of most vegetable protein fermentation (Yong and Wood, 1977; Oyeyiola, 1989; Sarkar *et al*., 1993). The titratable acidity range within 0.60 and 0.69. Both the pH and titratable acidity of the products signifies its quality and they were still within the pH and titratable acidity range in soybean dadawa fermented for 72 h (Omafuvbe *et al*., 2000).

The microbial count of the microorganisms in the iru samples are shown in Table 4. RCFP recorded the highest total viable count, though it is still in line with the total viable count reported by Atalabi (1984) on the fermentation of locust bean at 72 h. Lactic acid bacteria and *Bacillus* sp. are associated with fermentation. RCFP recorded the highest number of lactic acid bacteria of 4.50 $\log_{10}$ cfu g^{-1} and *Bacillus* sp. of 3.50 $\log_{10}$ cfu g^{-1}. A similar result was obtained during locust bean fermentation of *Pentaclethra macrophylla* (oil bean seed) to produce ugba (Obeta, 1983). *Staphylococcus* sp. were present in small amount 1.1 $\log_{10}$ cfu g^{-1} in BCFC and 1.4 $\log_{10}$ cfu g^{-1} in BCFP as contaminants. There was no fungal growth in any of the iru samples, probably because the samples were not incubated for so long as to favour the growth of fungus.

The sensory evaluation of the products is shown in Table 5. There was no significant difference ($p<0.05$) in the taste of all the iru samples. Although all the iru samples were acceptable, RCFC was the most preferred in terms of colour and texture.

This study showed that soy-iru could be processed using either the method of boiling or roasting. It could be fermented using either calabash or plastic with the nutrient not devalued. The RCFC proved to be the most appropriate method for the processing and fermentation of soy-iru as it contained and recorded the highest nutrient composition. It is also the most preferred by the sensory panelists when evaluated.

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