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Production and quality evaluation of garri-like product from sweet potatoes

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ABSTRACT

The potential of sweet potato as a source of producing a Garri-like product using the conventional cassava Garri processing Technology was examined. Four (4) samples were produced with varied fermentation periods; SPF–1 (24 hours), SPF-2 (48 hours), SPF-3 (72hours), while SPNF was not fermented. The proximate composition shows that the three (3) days fermentation sample (SPF-3) has a higher protein content of 3.58%. The ash content was observed to increase with fermentation period of a day (24hours) and subsequently decreased with increase in fermentation period from 1.82% (SPF-2) to 1.41% (SPF-3) respectively. The water absorption capacity increased directly with the length of fermentation period from 7.70% (SPNF) to 8.16% for SPF–3. $_{P}H$ decreased from 7.18 to 6.16 and TTA increased from 0.12% to 0.27% respectively, with increased fermentation period. There was significant difference in all the sensory attributes of the four (4) sweet potato Garri samples. However, sample SPF-3 is most preferred in terms of taste. Sensory attributes of SPNF and SPF-1 were not significantly different.

Key words: Garri, fermentation, sensory attributes, sweet potato and physicochemical analysis.

INTRODUCTION

Sweet potatoes (*Ipomea batatas*) is a leafy plant with strong dark green to brown colour tracing or twining stems. Like other tubers, it is a thickened underground starch storage organ of the plant. It is ranked the 7th in the world production after wheat, maize, rice, Irish potato, Barley and cassava. Sweet potato is mostly grown in the Northern part of Nigeria, especially in Zamfara state, due to its semi-rainfall demands since it can not tolerate drought and can thrive in a wide range of soils.

According to Kordylas, J.N [1], Garri is a fermented gelatinous granular flour obtained from cassava (*Mannihot Spp*). It is one of Nigeria's most popular staple foods reported to contribute up to 60% of total calorie intake of the population being a source of carbohydrate for many Nigerians.

Garri is widely consumed either in its intact form with sugar, groundnut or transformed into Garri meal eaten with soup. Since it is a ready-to-eat, easy to prepare food item, its acceptability cuts across all economic and social strata. The tuber is rich in carbohydrate, a fair source of Lipids, acid and has low fibre content. About 4.7% of the carbohydrates in sweet potato consists of sugars. Moreover, when compared with other roots and tubers, Sweet Potato has the highest sugar, thiamine and vitamin C contents.

Kordylas, J.N [2] reports that the tubers are rich in diatase which are enzymes that changes starch to malt, which is mainly responsible for its peculiar sweetness. The yellow and orange varieties are very rich in carotenes and vitamin C. It is also worthwhile to note that no toxic compound has been reported in sweet potatoes. Sweet potatoes are commonly sold as a tuber and then converted to suit the consumers need either by boiling, frying, roasting, mashing or baking and consumed immediately.

The fermentation of sweet potato tubers for the manufacture of Garri-like product provides an entirely different product from the commercially available as well as home-made sweet potato products. Furthermore, seasonal waste of the tubers can be reduced by producing a more shelf-stable food item. This further encourages diversification and paves way for wider production and varied use of the tubers. This work is aimed at the production of sweet potato "Garri" and evaluation of its proximate, physico-chemical and sensory qualities respectively.

MATERIALS AND METHODS

Materials: Sweet potato (*Ipomea batatas*) were purchased at the main market, Kaura –Namoda in Zamfara State.

1.1.1 Method for production of sweet potato garri.

The sweet potato Garri was produced according to the modification of the method as described by [1]. The fresh raw sweet potato tubers were washed, peeled (manually) under running water and washed again. The tubers were then sliced and grated to a pulp using a grater (2mm). The pulp was then put into cloth bags and pressure applied by heaping heavy stones on it to drain the excess water. The pulp was left in the bags to ferment for a period of 0,1,2 and 3 days respectively to vary the level of sourness. The pressed cake was then roasted to dryness at a temperature of 110^0C – 130^0C. The freshly prepared Garri were allowed to cool after which each was packaged and labelled accordingly.

1.1.2 Proximate Analysis

The moisture, ash, crude fat, crude protein and crude fibre were determined by the [3] methods. Carbohydrate contents were determined by difference.

1.1.3 Physico chemical analysis

Total titratable acidity (TTA), $_p$H and soluble solid (Brix) were determined using the methods of [3]. The water absorption capacity (WAC), loose and packed bulk densities and the swelling index were determined as described by [4].

1.1.4 Sensory Evaluation

Four coded Garri samples were presented to ten (10) semi- trained panelists familiar with Garri. Soaked garri samples were evaluated for colour, flavour, aroma, mouth feel, taste particle size, sourness and overall acceptability while the cooked samples (Eba) were evaluated for colour, texture, aroma, drawability, mouldability and overall acceptability respectively. Assessment was done on a nine-point hedonic scale [5] and results analyzed using the **ANOVA at 95% confidence limit**. Mean seperation was done using Turkey's test [6].

RESULTS AND DISCUSSION

The results of various evaluations carried out on the samples are given below:

TABLE 2.1 Proximate composition of sweet potato garri samples.

Samples	Moisture (%)	Ash (%)	Crude lipid (%)	Crude protein (%)	Crude fibre (%)	Soluble carbohydrate (%)
SPNF	8.55	1.40	0.46	3.07	3.25	83.27
SPF-1	8.43	1.48	0.74	2.56	2.75	84.04
SPF-2	10.03	1.82	1.43	2.56	3.50	80.66
SPF-3	8.16	1.41	1.43	3.58	2.25	83.17

SPNF *Sweet potato not fermented*
SPF-1 *Sweet potato fermented for 1 day*
SPF-2 *Sweet potato fermented for 2 days*
SPF-3 *Sweet potato fermented for 3 days*

From the moisture content results obtained from Table 2.1 above, SPF-2 has the highest value, there by making it more susceptible to microbial spoilage than any of the other samples. On the other hand, SPF-3 with the least moisture content would have a longer storage life.

The fat content of the products varies in this order; SPF-2 = SPF-3> SPF-1>SPNF.

The ash content of the samples decreased as the fermentation period increases, which indicates that minerals were lost during fermentation.

Conclusively, the nutritional composition of Garri like product from sweet potato is quite high making it very nutritious.

TABLE 2.2 Physico- chemical analysis for products

Parameter	SPNF	SPF-1	SPF-2	SPF-3
$_p$H	7.10	7.18	7.12	6.16
TTA (%)	0.050	0.122	0.191	0.274
Brix	1	2	1	1

From the results obtained in Table 2.2 above, the $_p$H and the total titratable acidity (TTA) of the samples reduced and increased respectively as the days of fermentation increased. This indicates that there is the production of Lactic acid as fermentation progressed. The brix shows there is little sugar left in the products after frying.

TABLE 2.3 Physical Characteristics

Parameter	SPNF	SPF-1	SPF-2	SPF-3
Water absorption capacity (%)	7.70	7.88	8.05	8.16
Loose bulk density (g/cm^3)	0.45	0.36	0.46	0.42
Packed bulk density (g/cm^3)	0.50	0.51	0.58	0.54
Swelling index (%)	84.33	86.45	91.33	89.95

The magnitude of water absorption capacity increases as the fermentation period increases. Sample SPF-3 has the highest value, hence it is the best in terms of ability to re-constitute when water is added.

In terms of bulk density, sample SPF-1 has the lowest value, while sample SPF-2 with the highest value.

TABLE 2.4; Sensory evaluation result for soaked sweet potato garri samples

Sample	Colour	Taste	Flavour	Particle size	Sourness	Mouth feel	Overall acceptability
SPNF	4.4^b	2.3^b	3.8^b	3.7^b	2.9^b	5.0^a	6.1^a
SPF-1	5.0^a	1.7^b	4.5^b	3.2^b	3.0^b	3.4^b	5.7^a
SPF-2	5.6^a	2.9^b	4.9^a	5.2^a	3.9^b	5.1^a	6.1^a
SPF-3	7.9^a	6.2^a	5.2^a	7.4^a	5.4^a	7.4^a	6.5^a

Note: Values with the same superscript on same column are significantly the same with each other (P < 0.05), while those values with different superscript are significantly different from each other.

From sensory evaluation results obtained for soaked sweet potato garri samples in Table 2.4 above, there is significant difference in all the sensory attributes for the four (4) sweet potato Gari samples. However, sample SPF-3 is the most preferred since it has the highest mean scores for all parameters and is significantly different from other samples in terms of taste, flavour and sourness (Table 2.4). Furthermore, there was no significant difference in sensory attributes of sample SPNF and SPF-1 except for colour and mouth feel. Sample SPF-2 is significantly different from SPFN and more acceptable, but not significantly different from sample SPF-1. SPF-2 and SPF-3 are similar in sensory attributes but significantly different in terms of taste and sourness. On the whole, all sample were generally acceptable and similar in overall

TABLE 2.5 Sensory evaluation results for "EBA" garri samples

Samples	Colour	Taste	Flavour	Mouldabilitly	Sourness	Mouthfeel	Overall Acceptability
SPNF	3.6^{b}	2.3^{b}	3.3^{b}	7.0^{a}	1.9^{b}	4.1^{b}	5.3^{a}
SPF – 1	3.4^{b}	1.8^{b}	2.9^{b}	6.4^{a}	2.3^{b}	2.3^{b}	5.7^{a}
SPF – 2	3.1^{b}	2.9^{b}	3.3^{b}	6.3^{a}	3.6^{b}	4.5^{b}	6.1^{a}
SPF – 3	4.7^{b}	6.2^{b}	5.4^{b}	6.7^{a}	8.3^{a}	7.2^{a}	6.5^{a}

Note: Values with the same superscript within the same column are significantly the same with each other (P < 0.05), while those values with different superscript are significantly different form each other.

From sensory evaluation results obtained in Table 2.5 above for Eba, there is significant difference in all the sensory attributes for the four (4) Eba samples. However, sample SPF-3 is the most preferred in terms of all parameters with the exception of Mouldability due to its lower mean scores when compared to SPNF. Conclusively, sample SPF-3 is the most acceptable for both soaked garri and Eba.

CONCLUSION

This research has shown that sweet potato, which is readily available all year round can be used to produce a Garri-like product with high nutritional value. The resulting product does not have the sweetness associated with sweet potato; it is off-white in colour and of lesser weight but favourably acceptable as indicated by sensory evaluation results. Finally, since enzymatic browning and loss of nutrients can be prevented, sweet potato can be a substitute for cassava in the production of Garri.

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