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THE QUALITY ATTRIBUTES OF *GARI* SOLD IN SOUTHWESTERN NIGERIA

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ABSTRACT

Work on the quality attributes of gari sold in southwestern Nigeria is reported. This was with a view to determine the extent to which the product has conformed to FAO standards. Ten samples of gari were randomly collected from five markets within the study area. The proximate composition and physical properties of the samples were determined using standard methods and data were analysed statistically. Results showed that the crude fibre content ranged between 1.00-1.90%, moisture content 8.5-14.5%, ash content 0.24-1.97%, carbohydrate content 80.91%-87.4%, swelling capacity (29.70-57.40%), water absorption capacity 3.85-6.10g/g, bulk density 2.39-2.79g/cm^3 and pH 5.50-6.60. The statistical analysis of the physicochemical properties of the samples showed variations at $p \leq 0.05$ level of significance in the properties of the samples within the same market. The crude fibre and moisture content of sample 1 and 4 respectively were not significantly different ($p \leq 0.05$) from the recommended FAO standard while the ash content is significantly different. All the properties of the other samples were significantly different from the recommended FAO standard at 95% confidence level. The nutritional compositions of gari though highly variable for all the quality assessed were lower than the recommended FAO standard except for the moisture content of samples 2 and 6 which were significantly higher at 95% confidence level. In conclusion, there is the need, for enlightenment of all the stakeholders to ensure the attainment and maintenance of the minimum quality standards for gari sold in the markets as recommended by FAO.

Keywords: *Gari*, proximate composition, physical properties, contamination, packaging

Introduction

Traditionally cassava roots are processed by a variety of methods into many different food products depending on locally available processing resources, local customs and preferences (Balagopalan, 2002). Cassava is processed and eaten in many forms, boiled as a vegetable, sliced, dried and milled into flour or grated and *garified* to produce gari. Gari, the most commonly used form of cassava in West Africa, accounts for some 70% of the entire cassava production in Nigeria (IITA, 2005). It has been estimated that between 4 and 5 million tonnes of cassava roots are used each year for this purpose. A lot of processing equipment and technology has been developed by various government and private organizations in Nigeria to facilitate the processing of cassava roots so as to reduce losses. The integrated cassava project of IITA has developed various equipments and the production of small-scale cassava processing equipment has enhanced the increase in production of gari, *fufu/akpu, starch, abacha, tapioca, kpokpogari* and l*afun* (Cassava flour) among the rural dwellers.

Gari is a granulated, white or yellowish product with 10 to 15% moisture content that permits a long conservation in normal atmospheric conditions. It has a high swelling capacity and can absorb up to 4 times its volume in water. It is a popular diet eaten in many flavours: in sweetened water with groundnuts/peanut or pressed nut flakes. It can be transformed into porridge with hot water (popularly called *eba* in Yoruba) and eaten with a variety of sauces (Vegetable, meats, fish); it can be used as a supplement to cooked beans' preparations and a variety of sauces. The nutritional supplement provided by gari is presented in Table 1. The main consumption areas in Africa cover Nigeria, Benin, Togo and Ghana. The other actual Africa's consumption markets (Niger, Burkina Faso, Ivory Coast, Guinea, Chad, Gabon, Congo, and Cameroon) are marginal. In the main consumption area, 80% of the populations eat gari on a daily basis (together with maize flour in Benin and Togo). The remaining portion of the populations (20%) eats gari twice per week, with the intake per person and per day averaging 100 grams (Quenum, 2004). The conservatory evaluation about the actual gari's Market (Metric Tonnes) in the main consumption area (Nigeria, Benin, Togo and Ghana) is as shown in Table 2. Nigeria is the largest producer, with the largest production and consumption of gari.

Table 1: The nutritional supplements provided by gari

Nutriments provided by 100 grams of gari	Quantity
Dried matters (gram.)	99
Calories (Kcal)	334-360
Proteins (gram.)	1.12
Lipids (gram.)	0.61
Global Glucocides (gram.)	87.30
Indigestible Glucocides (gram.)	1.82
Ashes (gram.)	1.03
Calcium (mg)	30.30
Phosphorus (mg)	54.55
Iron (mg)	4.55
Thiamin (mg)	54,55
Riboflavin (mg)	45.45
Niacin (mg)	1.00
Ascorbic acid (mg)	6.06

Source: Quenum, 2004

The popularity of gari is based probably on the fact that the granules are precooked, thus, a very short time is needed to prepare them as main dishes or snack. However, during processing there is often little or no quality control of the finished product, which may result in the product having higher moisture content than recommended, thereby making it unsuitable for long-term storage. Enforcing quality measures is a difficult task due to the large number of processors and the relatively small output of each one. The variation in the quality of products in the same market can be tremendous and adulteration of cassava products is common.

Table 2: Evaluation of the actual gari market in main consumption area in 2003

Items	Countries	Nigeria	Benin	Togo	Ghana
A	Fresh Cassava Production (MT x 1,000 - Year 2003)	76.789	3.310	2.775	9.760
A-bis	Quantities of fresh cassava used to produce gari	70.602	3.160	2.385	9.309
B	Population x 1,000 - (Year 2003)	150.474	6. 737	5.085	19.842
C	B x 80% x 100gr. x 365 days - (MT)	4,393.841	196.720	148.482	579.386
D	B x 20% x 100gr. x 52 weeks x 2- (MT)	312.985	14.013	10.577	41271
E	Total consumption of Gari (MT)	4,706.826	210.733	159.059	620.657

Source: Quenum, 2004

The poor quality packaging often limits the market that micro-entrepreneurs can serve. The number of announcements of sudden deaths of whole families in Nigeria after eating cassava meals certainly warrants quality assurance during production. This is particularly important for small scale level, because their products feed the populace while products from medium scale enterprises go into the export market and are monitored by the regulatory agencies (Ene, 1992; WREN, 2003).

Gari produced in Nigeria are usually packaged and stored in hessian sacks. The products are sold in open containers, polyethylene sheets or mats using small measures. The use of hessian sacks by the local producers for the packaging of these products is due to the fact that the material is cheap, readily available and durable. The material also has ease of bulk packing and transportation of products with little or no attention paid to the quality of products stored. The hessian sack is not moisture proof or airtight, and the hygroscopic nature of gari makes the use grossly unsuitable. The hessian sack can easily be torn due to continuous handling and re-use leading to losses of products during storage and transportation. Gari stored in hessian sack in a humid atmosphere can absorb sufficient moisture making them vulnerable to fungal and microbial growth, change in color, odour and taste, caking, etc, thereby reducing the quality and market value and may lead to food poisoning, when consumed.

The sale of gari from open containers, polythene sheets or mats also leads to contamination by dusts, stones and other contaminants. However there are recommended quality standards as given by FAO in codex standard for gari; it includes a maximum of 12% moisture content, 2.0% crude fibre, 2.75% ash content and 2.0mg/kg HCN. Gari is also expected to be free from abnormal flavor, odours, living insects and filth in amount which may represent hazards to human health. The objective of this work therefore is to evaluate the qualities of the gari sold in Ogbomoso, Oyo state Southwest Nigeria with a view to ascertain its attainment of the minimum required standard for gari as recommended by FAO.

METHODOLOGY

Samples of gari were collected at five markets (Sabo, Arada, Akande, Iresa-apa and Odo-Oba) within and outside Ogbomoso town in Southwestern Nigeria for analysis. Odo-Oba and Iresa-apa markets are major markets in Southwestern Nigeria for selling gari; hence these samples will give a good representation of gari produced in this area. Two samples were collected per markets; their nutritional and physical properties were determined by the procedures prescribed by AOAC (2002) for the evaluation of the proximate composition of food. The ash, fibre, protein, moisture, cyanide, swelling capacity, density, water holding capacities are among the quality determined. The selected quality attributes of the products were then compared with the recommended quality standard as given by FAO (1991) in codex standard for gari to determine the safety and nutritional qualities of the gari sold for consumption in Southwestern Nigeria markets.

RESULTS AND DISCUSSION

The nutritional and physical compositions of ten gari samples from the sampling units are as presented in Table 3 and Table 4 respectively. Samples 1 and 2 are from Sabo, 3 and 4 from Arada, 5 and 6 from Akande, 7 and 8 from Iresa-apa, 9 and 10 from Odo-oba markets respectively. The crude fibre

(1.90%), bulk density (2.79g/cm^3) hydrogen cyanide (1.30mg/kg) and pH (6.60) contents were highest in gari from Sabo markets, while the ash content (1.97%) and water absorption capacity (6.10g/g) were highest in gari from Arada market. The fat content (1.12%), moisture content (14.50%), and swelling capacity (57.40%) were highest in gari from Akande markets, highest density (1.10g/cm^3) were observed in gari from Iresa-apa markets, while the crude protein content (1.40%), carbohydrate content (87.40%) were in observed in gari from Odo-oba markets.

The least swelling capacity (29.70%), water absorption capacity (93.85g/g) and pH (5.50) contents were observed in gari from Sabo markets, while the least crude protein (0.98%) and hydrogen cyanide contents (0.30mg/kg) were in gari from Arada market. The least moisture content (8.50%), crude fibre (1.00%) and ash (0.60%) contents were in gari from Odo-oba markets. The properties of gari are in agreement with that reported for gari and cassava products by Akindahunsi *et al.* (1999); Oboh and Akindahunsi (2003); Ikhu-Omoregbe, 2008, Oluwole *et al.* (2004) and Opara, 1999.

However there are recommended quality standards as given by FAO/WHO (1991) in codex standard for gari it includes; a maximum of 12% moisture content, 2.0% crude fibre and 2.75% ash content. Gari is also expected to be free from abnormal flavor odours, living insects and filth in amount which may represent hazards to human health. The statistical analysis of the result showed variations at $p<0.05$ level of significance in the properties of the samples within the same market (Table 3 and Table 4). This showed that the variation in properties is not a function of the market. The crude fibre content of sample 1 and moisture content of sample 4 were not significantly different ($p \leq 0.05$) from the recommended FAO standard while the ash content is significantly different. All the others samples are significantly different from the recommended FAO standard at 95% confidence level. The average nutritional properties of gari in southwestern Nigeria are as shown in Figure 1.

The nutritional compositions of gari though highly variable for all the quality assessed are lower than the recommended FAO standard except for the moisture content of samples 2 and 6 which were significantly higher at 95% confidence level. A maximum moisture content of 14.5% was observed in a sample of from Arada market the wide variation in the moisture content was discovered to be a function of the processing methods, type of packaging materials used and the storage duration (Akindahunsi *et al.*, 1999; Oboh and Akindahunsi, 2003). The high moisture content will enhance microbial growth on the product leading to contamination, spoilage and poor shelf-life thereby making it unsuitable for long term storage. There are no specific standard given for the physical properties of gari however there was no significant difference ($p \leq 0.05$) in the density while there were significant difference in all the other physical properties of the samples.

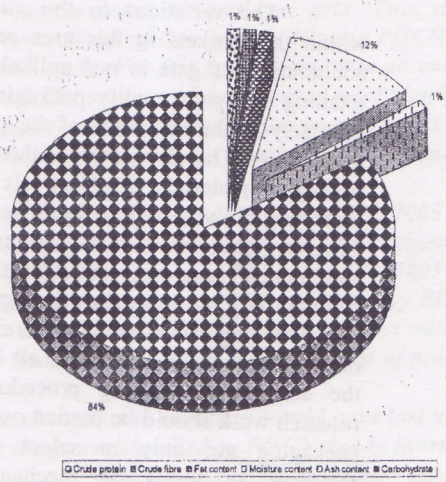

Fig. 1: The average nutritional properties of gari sold in southwestern Nigeria

The proximate values and physical properties of gari have been reported to be a function of the cassava variety, age of cassava, time of harvesting, the processing methods, packaging methods, storage conditions as well as the duration of storage (Oduro *et al.*, 2000; Chuzel and Zakhia, 1991). This could be the reasons for the wide variations in the qualities of the gari sold within the same market.

Table 3: Mean[1,2] Nutritional Composition of *gari* samples sold in southwestern, Nigeria

S/No	Crude protein	Crude fibre	Fat content	Moisture content	Ash content	Carbohydrate content	HCN
1	1.03^{a}	1.90^{d}	0.90^{a}	11.10^{d}	1.10^{c}	83.80^{b}	0.013^{e}
2	1.12^{a}	1.00^{a}	1.04^{b}	13.50^{g}	1.06^{c}	80.91^{a}	0.005^{a}
3	1.01^{a}	1.00^{a}	1.03^{b}	11.00^{d}	1.97^{e}	83.01^{b}	0.003^{a}
4	1.03^{a}	1.33^{bc}	1.20^{c}	12.00^{f}	0.24^{a}	83.88^{b}	0.004^{a}
5	1.07^{a}	1.33^{bc}	1.09^{c}	11.50^{e}	0.63^{b}	84.41^{a}	0.010^{d}
6	1.10^{a}	1.10^{b}	1.02^{b}	14.50^{g}	1.57^{d}	80.17^{a}	0.010^{c}
7	0.99^{a}	1.02^{b}	1.02^{b}	10.20^{bc}	1.07^{c}	84.42^{b}	0.003^{c}
8	1.30^{b}	1.20^{bc}	0.88^{a}	10.30^{bc}	1.63^{d}	84.12^{b}	0.004^{b}
9	1.40^{b}	1.00^{a}	1.03^{b}	8.50^{a}	0.60^{b}	87.40^{c}	0.010^{d}
10	0.99^{a}	1.01^{a}	0.98^{b}	10.00^{b}	0.68^{b}	86.34^{b}	0.010^{d}
Average	1.10	1.93	1.09	11.26	1.06	83.85	0.020
FAO recommended standard (max)	-	2.00^{d}	-	12.00^{f}	2.75^{f}	-	-

[1] Means of three replicate [2]Means with the same letters for a particular measurement are not significantly different ($p \leq 0.05$)

Table 4: Mean[1,2] physical properties of *gari* samples sold in Ogbomoso, Nigeria

S/No	Density	Swelling capacity (%)	Bulk density (g/cm^3)	Water absorption capacity g/g	pH
1	1.10^{a}	29.70^{a}	2.79^{d}	3.85^{a}	5.50^{a}
2	1.00^{a}	40.10^{d}	2.52^{abc}	5.10^{e}	6.60^{d}
3	1.01^{a}	39.40^{cd}	2.47^{ab}	4.75^{bc}	6.00^{cd}
4	1.01^{a}	57.40^{g}	2.52^{abc}	6.10^{d}	6.40^{cd}
5	1.01^{a}	38.70^{bcd}	2.48^{ab}	4.75^{bc}	6.50^{cd}
6	1.01^{a}	37.50^{b}	2.65^{cd}	5.00^{bc}	6.30^{c}
7	1.01^{a}	50.10^{f}	2.59^{bc}	4.80^{bc}	6.40^{cd}
8	1.10^{a}	42.10^{e}	2.39^{a}	4.38^{ab}	5.90^{b}
9	1.04^{a}	38.20^{bc}	2.45^{ab}	4.75^{bc}	6.40^{cd}
10	1.06^{a}	39.40^{cd}	2.53^{abc}	4.57^{bc}	6.30^{c}
Average	1.04	41.26	2.52	4.81	6.27

[1] Means of three replicate [2]Means with the same letters for a particular measurement are not significantly different ($p \leq 0.05$)

CONCLUSION

The variations in the quality of gari sold within the markets in this area are tremendous and adulteration of gari is not unlikely. The method of retailing and poor quality packaging also contributes adversely to the insurance of the gari quality sold in the markets. Therefore, there is the necessity to evolve packaging materials to effectively provide complete protection of the dehydrated products against moisture, light, air, dust, micro flora organisms, foreign odour and animal pest, provide strength and stability to maintain original properties through storage, handling and marketing. Efforts should therefore be made by the relevant agencies to enlighten all the stakeholders on the standard processing procedure of gari. More research work should be carried out in the area of gari packaging not only to select suitable packaging materials in terms of mechanical strength and durability, but also to maintain quality and to extend the shelf life of the product.

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