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Evaluation of Total Cyanide and Proximate Analysis of Garri Produced from Cassava *Manihot esculeuta Crantz* Variety from Five Local Government Area in Ekiti State, Nigeria

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Abstract

Cassava is traditionally processed, fermented and converted to garri and has become a major source of daily carbohydrate intake in Nigeria and other African countries. The cyanide content and proximate composition of garri produced from cassava *Manihot esculeuta Crantz* variety collected from five local government areas of Ekiti state were studied. The results showed that cyanide content in all the samples ranges between 1.02 ± 0.01to 1.34 ± 0.02 mg/kg except for Gbonyin LGA with 0.09mg/kg, the low cyanide level was attributed to fermentation of at least three days before roasting. The outcome of proximate analysis revealed that moisture contents ranged 9.78 ± 0.01 to 10.76 ± 0.02 %, ash contents ranged 0.09 ± 0.01 to 0.18 ± 0.01 %, fat contents from 0.87 ± 0.01 to 1.23 ± 0.01 %, crude fibre from 1.21 ± 0.01 to 1.42 ± 0.01 %, crude protein from 0.28 ± 0.01 to 1.81 ± 0.01 % and carbohydrate contents ranged from 84.71 ± 0.02 to 87.67 ± 0.01 % are within the recommended levels. The low moisture content and the moderate level of other compositions make the garri products suitable nutritional food items.

Keywords: Cyanide, Cassava, Proximate analysis, Fermentation, Garri, Nutritional.

Introduction

Cassava *Manihot esculenta Crantz* is a perennial, woody plant known to be one of the few important root crops in many countries across Africa and some Asian countries. Cassava origin was traced to tropical America and was first introduced into Africa through Congo basin by the Portuguese around 1558 (IITA, 2021). Though native to South America, cassava is now extensively grown as an annual crop in many parts of the world especially tropical and subtropical regions. This is a prolific crop that is drought tolerant and can grow in poor soil, the crop can withstand adverse soil and climatic conditions in regions where the roots serve as a dependable staple food for millions of people and the third largest source of dietary Carbohydrate. On the other hand, it can have dangerous effects, especially if it is eaten raw and in large quantity. Cassava provides a small amount of fiber, vitamins, and minerals for the body. It can be processed into wide varieties of domestic meals, depending on local customs and preferences, for human consumption. (Ibegbulem and Chikezie, 2018; NWEC, 2020).

Cassava roots can be processed to several products, that include garri, bread, flour, and starch. Traditional methods of processing can result in poor quality products that contain unacceptable levels of cyanide, if not well supervised. All known cassava cultivars contain cyanide above the recommended level (Ubwa et al, 2015).

Proper processing converts fresh cassava roots into safer and more marketable products, prolongs the shelf life of the products, reduces losses that may occur after harvest, avoids environmental pollution and contamination of the products, increases the nutritive value and reduces costs of transport (James *et al*, 2012).

Cassava are categorized into two varieties namely sweet (low-cyanide) or bitter (high-cyanide), which signifies the absence or presence of toxic levels of cyanogenic glucosides. Cassava grown during drought contains higher toxins (NWEC, 2020).

The bitter variety leaves of cassava are used in the treatment of hypertension, headache, irritable bowel syndrome, fever, and other pains (Sylvia, 2016; Kuete, 2014).

Proximate analysis of cassava was done to determine the value of macronutrients in it. It is used in the analysis of biological materials as a decomposition of human consumable goods into its major constituents.

Toxicity of hydrogen cyanide (HCN) which is caused by hydrolysis of cyanogenic glucosides during crushing is a major factor limiting the use and consumption of cassava. Increase ingestion of cyanide in human diets can lead to diseases like goiter, paralysis, cretinism and neurological symptoms arising from tissue damage in the central nervous system (CNS) (Ojo and Akande, 2013).

Fermentation as applied in garri production, sun drying and cooking were able to reduce the level to an acceptable standard. These techniques assist to damage the plant tissues and permit the liberation of the hydrogen cyanide.

Fresh cassava roots deteriorate within two to three days after harvest, and therefore must be processed immediately to finished products. Cassava is propagated by cutting a mature stem into sections of approximately 15 centimeters and planting prior to wet season (NWEC, 2020).

To avoid health hazards by contamination of fresh cassava, good hygiene conditions must be maintained in every stage from harvesting, transportation to production, this is necessary to ensure that the roots are not contaminated by biological or chemical residues. In particular, contamination by animal manure and feacal material must be prevented during and after harvesting (Abass *et al*, 2012).

The cassava variety and method of processing adopted determine the quality of the garri (Abass *et al*, 2012).

Garri samples containing cyanide in surplus of the maximum World Health Organization endorsed safe level of 10ppm is not good for human consumption (Ojo and Akande, 2013). The aim of this research work is to investigate the proximate composition of garri produced from Cassava *Manihot esculenta Crantz,* to discover the extent to which the samples fulfill dietary requirement.

- To evaluate the cyanide content and,
- To determine how suitable, the samples are for human consumption.

The outcome of this study will give an insight into the food value of cassava products especially garri.

Materials and Methods

Garri samples were collected from marketplaces in five local government areas of Ekiti state in polythene bags, the towns are Ido Ekiti in Ido/Osi LGA, Ijero Ekiti in Ijero LGA, Aisegba Ekiti in Gbonyin LGA, Emure Ekiti in Emure LGA and Ado Ekiti in Ado LGA.

The selection of the garri was based on the information supplied by the producer to ensure that safe agricultural methods and practices were used

Stages of garri production include peeling of fresh cassava roots, then washing and grating, fermenting, dewatering or pressing, breaking of the cake, sifting, roasting, sieving or grading, and packaging.

Proximate analysis

Proximate analysis of the samples was determined using the method explained by Association of Analytical Chemists (AOAC, 2009). The moisture content was determined by oven drying method maintained at 100°C - 103°C. Soxhlet apparatus was used to extract the crude fat, Muffle furnace was used for ashing, crude protein was determined using kjeldah method and the percentage nitrogen value was multiplied by 6.25, and finally, carbohydrate was calculated by difference.

Cyanide Content

Total cyanide contents of the garri samples were determined through hydrolysis by using AOAC (1990) method.

The concentration of cyanide in the sample was determined using;

$$mg/kg = \frac{13.5\,(V_O - V1)}{M}$$

V_O = Titre value of the sample

V1= Titre value of the blank

M = Mass of the sample

Results

The proximate analysis results (moisture, ash, fat, fibre, protein, and carbohydrate) of garri produced from cassava *Manihot esculenta Crantz* in five local government area of Ekiti state are shown in Table 1. The moisture contents ranged from 9.78% to 10.76%, ash contents ranged 0.09% to 0.18%, fat contents from 0.87% to 1.23%, crude fibre from 1.21% to 1.42%, crude protein from 0.28% to 1.81% and carbohydrate contents ranged from 84.71% to 87.67%. Ido/Osi LGA had highest percentages in moisture, fat and protein while Gbonyin LGA had the lower in moisture, ash,

The cyanide contents as shown in Table 2 ranged from 0.09 mg/kg to 1.34 mg/kg with garri from Ido/Osi LGA having the highest value of 1.34 mg/kg and Ado LGA with the lowest of 0.09 mg/kg. It also followed a descending patttern in the order of Ido/Osi > Ijero > Gboyin > Emure > Ado.

Table 1: Proximate analysis of garri fat and crude protein but high in Carbohydrate.

LGA	MOISTURE (%)	ASH (%)	FAT (%)	FIBRE (%)	PROTEIN (%)	CHO (%)
Ido / Osi LGA	10.76 ± 0.02	0.14± 0.01	1.23 ± 0.01	1.36± 0.01	1.81± 0.01	84.71 ± 0.02
Ijero LGA	10.13 ± 0.01	0.10 ± 0.01	1.12 ± 0.01	1.21± 0.01	1.15 ± 0.01	86.29 ± 0.01
Gbonyin LGA	9.78 ± 0.01	0.09± 0.01	0.87 ± 0.01	1.31± 0.01	0.28 ± 0.01	87.67 ± 0.01
Emure LGA	10.51 ± 0.02	0.11 ± 0.01	1.19 ± 0.01	1.42± 0.01	0.96 ± 0.01	85.82 ± 0.02
Ado LGA	10.57 ± 0.02	0.18 ± 0.01	0.97 ± 0.01	1.39 ± 0.01	1.30 ± 0.01	85.59 ± 0.02

Values are presented as means ± Standard Deviations.

Table 2: Cyanide Composition of garri

LGA	CYANIDE (mg/kg)
Ido / Osi LGA	1.34 ± 0.02
Ijero LGA	1.24 ± 0.02
Gbonyin LGA	1.05 ± 0.02
Emure LGA	1.02 ± 0.01
Ado LGA	0.09 ± 0.01

Values are presented as means ± Standard Deviations

Discussion

The moisture contents ranged from 9.78% to 10.76% with Ido/Osi having the highest value. This range compared fairly well with the maximum 12% recommended for shelf stable garri (Ojo and Akande, 2013). The ash contents ranged 0.09% to 0.18% and Ado LGA had the highest (0.18%). Mineral content of food products is determined by ash content of such food. These values recorded are good representation of the mineral content (Ojo and Akande, 2013). The crude fibre aids peristalsis passage of food through the digestive path as a result of its water absorption capacity (Abu *et al*, 2010). The crude fibre ranged from 1.21% to 1.42% with highest value from Emure LGA.

Gboyin LGA had the lowest protein level with 0.28% and the highest from Ido/Osi LGA (1.81%), fat content ranged from 0.87% to 1.23% with Ido/Osi LGA recording the highest value of 1.23% and Gbonyin LGA with lowest value of 0.87%. Fat and protein contents were found to agree with values reported previously (Peprah *et al*, 2020). Carbohydrate contents of samples from all the LGA studied ranged 84.71% to 87.67% were observed to be higher than previously reported (Peprah *et al*, 2020) with highest value from Gbonyin LGA.

Cyanide concentrations vary in different cassava according to the geographical location, season and production methods (Peprah *et al*, 2020). Fermentation methods adopted in processing cassava determine the cyanide level in any variety, and fermentation period of at least three days had the advantage of greater fall in cyanide through further disintegration of cyanogenic glucosides in the cassava pulp. The levels of cyanide recorded in the present study ranged 0.09 mg/kg to 1.34 mg/kg were within acceptable limit of 10 mg/kg as recommended by WHO (Ubwa *et al*, 2015).

Conclusion

The role of cassava as a major crop to get rid of hunger in Nigeria and Africa has necessitated the needs for genetic improvement for productivity of high yield cassava with safe cyanide content. Garri produced from cassava roots in Ekiti can compete favorably with similar garri obtained from other part of Nigeria. The low moisture content and other proximate compositions show their suitability as nutritional food products which can be fortified with groundnut, smoked fish and others.

Conclusively, the results obtained in this research work also indicate the effectiveness of fermentation of at least three days in depleting cyanide content. This is a key driver for WHO advocacy for food and nutrition security.

The research results showed that the proximate composition and the cyanide content of garri experimented on are within the acceptable limit of the regulatory bodies, and hence they are good for human consumption.

The local, state and federal governments should encourage the production of garri through funding of Small and Medium Enterprises (SMEs) for exportation

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