JOURNAL OF PURE AND APPLIED MICROBIOLOGY, October 2007. Vol. **1**(2), p. 211-214

Assessment of the Toxicological Potentials of Cassava Processed products in Nigerian market

A.K. Asiagwu*, P.A.C. Okoye, and P. Omuku

Department of Industrial Chemistry, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria.

(Received: 05 August 2007; accepted: 09 September 2007)

The presence of fungi metabolite of toxin-producing strains of *Aspergillus flavus* collectively termed' aflatoxins in some garri and cassava flour samples was investigated using paper chromatography and iodine vapour for detection. All the samples screened were found to contain at least one aflatoxin. Garri samples collected from Ochanja market in Onitsha and Ogbete market in Enugu contained a maximum of three aflatoxins namely B_1, B_2, and G_1. While, other samples collected from some other market contain a maximum of two aflatoxin.

Keywords: Food chemicals, contaminants of staple foods.

The presence of toxic substances in some staple food was discovered first in Britain when many turkeys died after consuming meal contaminated with aflaxtoxin from Brazil[1]. Investigation revealed that the metabolites consist of four major fractions collectively known as aflatoxin [1,2].

Aflatoxins are the best known mycotoxin and are group of acutely toxic and highly carcinogenic mold metabolites produced by strains of fungi known as *Aspergillus flavus.* The toxins have closely similar structures and form a unique group of highly oxygenated naturally occurring hetrocyclic compounds [3]. These substances are not only toxic to large number of species but their mixtures is carcinogenic[4]. *A. flavus* which are the cause of this toxin are distributed everywhere and every foodstuff is potentially susceptible to contamination under favourable condition [5].

The normal and natural food constituent is the greatest and widest variety of good chemical consumed by man toxicologically. In fact no single plant used as food has been absolutely characterized chemically[6]. One of the commonest foods, potato has been found to contain about 150 distinct chemical substances including nitrates, tannin, alkaloids, oxalic acid to mention a few and over hundred other substances of unknown significances[7]. Few of specific chemical substances in some Nigerian stafle food have been evaluated toxicologically and based on current standard of safety evaluation some of these chemical could be toxic when tested with experimented animals[8]. Toxicity of a substance may be defined as its intrinsic capacity to produce injury when tested[5,8]. The hazard of substance is its capacity to produce injury under the circumstance of exposure. However, in spite of numerous toxic substances consumed daily in our food, there is no immediate evidence that there is hazard. This is because these toxins are in low concentration and the amount-effect relationship of these toxin also depend on time of exposure. Thus, if environmental condition is held constant, the toxic effect is the result of the interaction between three factors: the organism, concentration of toxin and time[9].

The genesis of harmful or potentially harmful chemical substance in food substance called food contaminants or toxicant may be traced to two principal sources. The natural and synthetic contaminant. The natural contaminants are those

* To whom all correspondence should be addressed.
E-mail: drasiagwu@yahoo.com

substances which occur as normal components of natural food products, typical examples are cynogenic glycogens and phytochemcial trypsin, inhibitors, lathyrogens and goitrogene[7,9]. Also included in this group are the mycotoxins and non-microbiological toxicant such as mercury, lead, cadmium, etc[10]. Contaminants such as agricultural pesticide, fertilizers, food additives such as saccharin, nitrates, make up the synthetic or man-made contaminants. Other synthetic toxicants arise form chemicals produced during food processing, packaging, inadvertent or accidental contamination and environmental pollution.

The increasing demand on staple food in Nigeria has created the needed for processing, storage and market expansion of these food industry. It has therefore become necessary to investigate the toxicological chemical load of these food items, with a view to determining its potential effects on public health in the Nigerian environment.

MATERIAL AND METHODS

Garri samples were collected from five markets in the following towns: Enugu, Onitsha, Awka, Asaba and Owerri as can be seen in Fig. 1 showing the map of study area. Similarly, cassava flour sample was collected only in Onitsha market and examined.

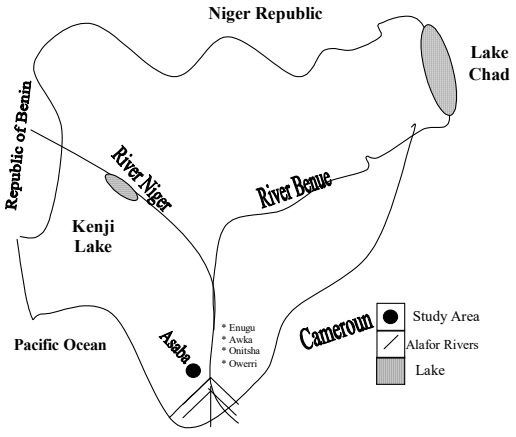

Fig 1. Map of Nigeria showing study area

Aflatoxins in the garri and cassava flour samples were extracted by using the procedures adopted by Verster[12]. 10g of each sample was placed in a separatory funnel, a mixture of acetone, hexane and water in the proportion of 27ml, 22ml and 1ml respectively was prepared and left for about 5 minutes for proper mixing. The Azeotropic mixture of acetone-hexane –water was added to the sample in the funnel, and the mixture was corked and shaken intermittently after which it was left for 12 hours. The extract was collected and concentrated by allowing the solvent to evaporate.

The extracted aflatoxins were detected by means of chromatography. Two chromographic tanks containing hexane and iodine crystal were set up differently. The on the chromatography paper marks were made at the 2cm and 12cm respectively. The concentrated extract was spotted on the chromatography paper at the 1cm mark before it was inserted into the chromatographic tank containing hexane. The tank was covered immediately to avoid loss of the solvent. The solvent was observed while it moved up the paper until it reached the 12cm mark before the paper was brought out and allowed to dry up a little, then it was finally inserted in the tank containing iodine crystal.

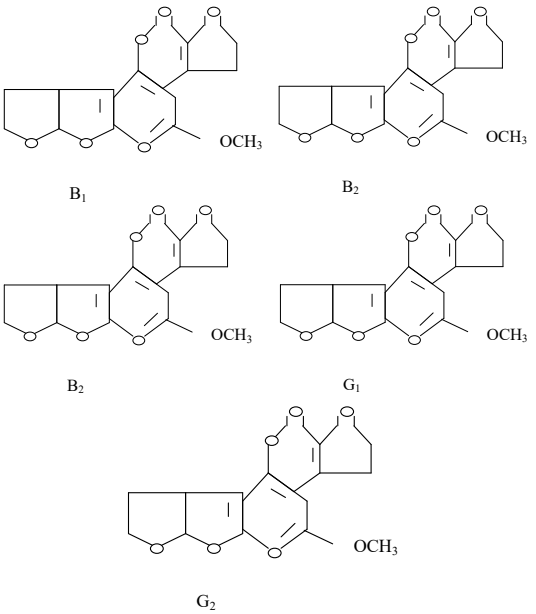

Fig. 2. Various forms of aflatoxins

The iodine tank was covered, then the various spots available were identified. The respective Rf values were calculated and recorded.

RESULTS AND DISCUSSION

In this study, aflatoxins were detected in Garri and Cassava flour using paper chromatography. The Rf values of the detected aflatoxin were recorded in Table 1. Table 2 showed number of aflatoxins in a particular garri and cassava flour sample. The Rf values were validated using standard aflatoxins. The comparison between the calculated Rf values were in consonance with those of the standard value which suggested the presence of aflatoxins B_1 and B_2 and G, in the samples. Garri samples collected from Ochanja market in Onitsha and Ogbate market Enugu, contained a maximum of three aflatoxins while others contained a maximum of two aflatoxins.

The problem of food contamination in Nigerian food may be traced to three principal sources namely. Processing, storage and

Table 1. The Rf values of detected aflatoxins

Market location	Rf values of garri samples				
	A	B	C	D	E
Ogbonogo market Asaba	0.47	0.47	0.70	0.50	0.48
	0.19	0.18	0.48	0.60	
Eke Awka market	0.80	0.48	0.71	0.52	0.48
	0.18	0.17	0.19	0.19	0.20
Ochanja market Onitsha	0.70	0.17	0.72	0.80	0.72
	0.46	0.46			
	0.17	0.18			
Old market Owerri	0.17	0.72	0.18	0.79	0.18
				0.50	
Ogbete market Enugu	0.49	0.19	0.71	0.18	0.72
			0.48		0.49
					0.18
		Rf values of Cassava samples			
Ochanja market Onitsha	0.47	0.48	0.47	0.18	0.18
				0.18	

Rf values for the standard aflatoxins
B_1 = 0.70; B_2 = 0.48; G_1 = 0.16; G_2 = 0.10

Table 2. Rf values of Aflaxotin from Garii and Cassava flour samples

Market location	Rf values of garri samples				
	A	B	C	D	E
Ogbonogo market Asaba	2	2	2	1	1
Eke Awka market	2	2	2	2	2
Ochanja market Onitsha	3	3	1	1	1
Old market Owerri	1	1	1	2	1
Ogbete market Enugu	1	1	2	1	3
		Rf values of Cassava samples			
Ochanja market Onitsha	1	1	2	1	1

Rf values for the standard aflatoxins
B_1 = 0.70; B_2 = 0.48; G_1 = 0.16; G_2 = 0.10

marketing. Similarly moisture is the single most important parameter for controlling toxigenic moulds [13]. It is therefore very important that moisture content of food billed for storage should be reduced to such a minimum safe value as to prevent the growth of moulds. The storage of food in Nigeria is poor usually in poorlyventilated lock-up stores that create humid atmosphere favouable for fungi growth.

Food like garri are usually marketed using open basins in most Nigerian markets. This means that in a humid atmosphere or if such food product is hygroscopic, it will pick up moisture from the atmosphere and create the environment for the growth of moulds and thus room for contamination. Since the discovery of aflaxtoxin in 1961, considerable progress has been made both from structure and biochemical aspects in the areas of its acute toxicity and carcinogenicity[14].

CONCLUSION

Aflaxtoxins B_1, B_2 and G_1 have been detected in samples of garri and cassava flour from our markets. The presence of this toxic substances may be as a result of processing, preservation and marketing.

Humid environment catalyse the growth of mycotoxoins. Even though this investigation was carried out during the dry season, it is still believed that sometimes the presence of sugar from incompletely fermented cassava should lead to the growth of fungi and hence increase the toxic load of the food sample.

In Nigeria, the Food and Drug Law focus to a fault mainly on manufactured good neglecting the staple agricultural foods. This attitude has lead to the proliferation of mycotoxin and other food contaminants in our markets. It is therefore necessary that the government though the food and drug law enforcement agencies should review its attitude in this direction and fashion out systems of checks and balances such as food inspection, testing and standardization.

REFERENCES

1. Allcroft, A. B. and Carnagham, R. B. A. Groundnut toxicity, an examination for toxin in human food products from animal groundnut med. *Vet Rec.* 1963; **75,** 259-263.
2. Alterrman, E. K. and Scott, A. T. Toxicity and Teroiogenicity of food additives chemicals in developing chicken embryo. *Toxical and appl. Phamaco.* 1980; **56:** 268-290.
3. Buchi, T. A. and Chong, M. M. The Structure of aflatoxins. *J. Am. Chem. Soc.* 1967; **87,** 882-886.
4. Asplin, F. D. and O. R. B. A. The Toxicity of certain groundnut meals for poultry with special reference to their effect on Ducklings and Chickens. *Vet Records.* 1963; **73**, 1215.
5. Astwilck, P. K. C. and Ayerst G. Groundnut Microflora and Toxicity. *Chem Ind.* London. 1963; **73,** 1215.
6. Bababummi, B. E. Effect of Aflaxtoxin isolated from mould foodstuff on the synthesis of micro molecules in the liver. *A J. Biol. and Appl Chem.,* 1969; **12,** 17.
7. Bassir, O.O., and Adekunle, A. Comparative toxicitus of aflatoxins B. and palmotoxin Bo and Gos' West. *African J. Biol and Appl Chem.* 1969; 7-9.
8. Bassir, O. and Alozie T. C. The effect of aflatoxin B1 on Blood clothing in Nigerian Monkey. *Toxicon.* 1979; **1:** 189-190.
9. Biount, W.P. Turkey "X" disease *J. Brit. Turkey Federation.* 1971; **52**, 61, 77.
10. Insiata, B. E.; Levi, M. E. and Witzman, J. S.; Mycotoxin in feeds and food, *Advanced Appl. Microbiology,* 1979; **8:** 315-317.
11. A Cieglar and R. E. Peterson. Aflatoxin detoxification bacteria JJP Press London. 1977; **67**, 178.
12. Vorster, L. J. Deloxification of Aflatoxin in Food Samples; King pp. Press Canada. 1989; 7-12
13. Semeniuk, G. Microfloara in Storage of Cereal Grains and their products; Association of Cereal Chemist Minaesota. 1985; 77-79.
14. Sinha, S. K. Screening of Chromophyllous plants against aflatoxin production and aflatoxin producing fungi. *India J. Food Sci and Tech.,* 1999; **22,** 225.