World Journal of Agricultural Sciences 6 (1): 79-82, 2010
ISSN 1817-3047

Aflatoxin Levels of Some Common Food Items Sold in Ekpoma, Nigeria

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Abstract: The levels of aflatoxin in some common food items sold in Ekpoma were investigated between the period of October 2007 and May, 2008. Using the Affinity Chromatography method, 10 samples of each food items screened were collected from 6 villages in Ekpoma town, Edo State, Nigeria. Sixty samples assayed were positive for aflatoxin contamination but 16 (26.7%) had aflatoxin level higher than the U.S. FDA standard acceptable level (20 μg/kg) for the food items examined. Aflatoxin contamination was the highest in kulikuli (mean value of 38.3 μg/kg) and this was statistically not significant (P>0.05). The most prevalent fungal isolate was *Aspergillus flavus* (81.7%). The food items most susceptible to aflatoxin contamination were the groundnut products and sweet potato. The groundnut product had aflatoxin level higher than sweet potato (mean value of 20.8 μg/kg) and this was not also statistically not significant (P>0.05). Results of this study underscore the need for our sanitary health inspectors to seriously monitor the preservative methods and sanitary conditions of foodstuffs displayed for sales in the street markets in our cities.

Key words: Aflatoxins · Levels · Foods · Ekpoma · Nigeria

INTRODUCTION

Aflatoxins are mycotoxins produced mainly by the molds *Aspergillus flavus* and *Aspergillus parasiticus,* which commonly contaminate food grains before and after harvest [1]. The toxicity of aflatoxins was recognized in the 1960s and it was later appreciated as a health problem for domestic animals and humans [2]. Worldwide substantial quantities of food grains are affected by mycotoxins each year. These include: Maize (16 million tons), rice (12 million tons), Sorghum and Millet (378,000 tons), Copra (3.1 million tons), Soybean (2.3 million tons) [3].

Aflatoxins are highly toxic, mutagenic, teratogenic and carcinogenic when substantial amounts accumulate in the body [4]. Aflatoxins are found in many countries especially in tropical and subtropical regions where conditions of temperature and humidity are optimum for growth of the molds and for production of the toxin [5]. Aflatoxin can be detoxified or removed from contaminated foods and feeds by physical, chemical and biological methods [6]. Aflatoxins have attracted worldwide attention due to the significant losses associated with their impact on human and animal health and consequent national implications. [7]. They can be immunosuppressive and impair humoral and cell-mediated immunity at high levels [8]. The impact of aflatoxins on man derives directly from the health hazards posed by aflatoxin contamination, crop and livestock losses, cost of regulatory programmes designed to reduce risks to animals and human health and other adverse economic effects [9]. Toxins produced by *Aspergillus flavus* prevent synthesis within the cell and the ability to mobilize fats [10]. Poor growth and changes in the liver consequently take place at levels of 1 part per million and up. Most animals affected become depressed, have poor hair coats,

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are anaemic, suffer chronic lesions from long feeding and frequently have convulsions [11]. Man is not an exception to the morbid effect of aflatoxin there is lowered performance with the resultant clinical manifestations [12].

In China, high aflatoxin level of 160-395 μg/kg/person was detected in the urine and blood samples of men who had liver cancer [13]. Studies in Ivory Coast, Mozambique, Sudan, Swaziland, China and Korea have reported high frequency of liver cancer compared with western countries [3]. The FAO has estimated that 21.5% of the world food crops are significantly contaminated with mycotoxin [14]. Adebajo and Idowu [15] detected Aflatoxin B1 in 22% of yam chips in Osun and Oyo States in Nigeria. They also reported the presence of aflatoxin contaminated herbal plants stored for sale at Ibadan. In Northern Nigeria, aflatoxin level as high as 2000 μg/kg was detected in groundnut cake, "kulikuli" [16]. Also, Melean *et al.,* [17] had detected an unsafe level of 45-370 μg/kg aflatoxin B2 in maize in Benin City, Nigeria.

MATERIALS AND METHODS

Ten different common food items were collected from 6 villages in Ekpoma town between October 2007 and May 2008. The samples collected were kulikuli (groundnut cake), corn, groundnut, plantain chips, fowl feed, sweet potato chips, cassava chips, Ahwonka (Sugared groundnut cake), cocoyam chips and yam chips. 2kg of each sample was sent to the laboratory in dated and labeled plastic bags for analysis. A representative sample was obtained by using an officially recognized sampling procedure [18]. After drying, about 1 kg each of the representative sample was finely ground and a 50g sub-sample was taken for the assay.

The materials used included the kit components which comprised of 25 aflascan immunaffinity columns, 25 florisil tips, 1 glass syringe barrel (10 ml), 1 plastic syringe, pump unit, 1 rubber connector and 1 fluorescent comparitor card.

The Affinity chromatography method as modified by Candlish *et al.* [19] was used to detect and quantity aflatoxin levels in the prepared food samples. The samples were also subjected to microscopic examination using a drop of potassium hydroxide (KOH) solution and X10 and X40 objective lens. The specimen was also inoculated on Sabouraud Dextrose Agar medium and incubated for four days at 37°C.

RESULTS

The highest and lowest aflatoxin levels attained in the assayed samples are recorded in Table 1. The two fungal isolates were *Aspergillus flavus* and *Aspergillus niger* of these, the most prevalent fungal isolate was *Aspergillus flavus* with a total percentage of 81.7% while *Aspergillus niger* had a total percentage of 18.3% (Table 2). Table 3 shows food samples most susceptible to aflatoxin contamination. *Aspergillus flavus* grew on Sabouraud Dextrose Agar (SDA) within three days, producing yellow-green colonies with rough granular

Table 1: The highest and the lowest Aflatoxin level attained

	Village/Aflatoxin level (μg/kg)					
Food items (samples)	Uweleneboh	Ujemen	Uhiele	Uhumudumu	Uwandova	Idumueboh
Kulikuli	35	40	40	35	40	40
Fowl feed	6	8	6	6	10	8

$\chi^2 = 1.035$; $P>0.05$

Table 2: The most prevalent organism isolated from the six (6) villages in Ekpoma

Village	Fungal isolate	% composition
Uweleneboh	*Aspergillus flavus*	100.0
	Aspergillus niger	100.0
Ujemeh	*Aspergillus flavus*	70.0
	Aspergillus niger	30.0
Uhiele	*Aspergillus flavus*	90.0
	Aspergillus niger	10.0
Uhumudumu	*Aspergillus flavus*	60.0
	Aspergillus niger	40.0
Uwendova	*Aspergillus flavus*	90.0
	Aspergillus niger	10.0
Idumueboh	*Aspergillus flavus*	80.0
	Aspergillus niger	20.0
Total percentage	*Aspergillus flavus*	81.7
	Aspergillus niger	18.3

Table 3: Food samples most susceptible to Aflatoxin contamination

	Village/Aflatoxin level (μg/kg)					
Food samples	Uwelene-boh	Ujemen	Uhiele	Uhumu-dumu	Uwendova	Idumueboh
Kulikuli	35	40	40	35	40	40
Ahwonka	30	40	35	30	30	25
Ground-Nut	20	20	30	20	25	20
Sweet potato	20	25	25	20	15	20

texture. The phialides covered the entire surface of the vesicle producing chains of conidia. *Aspergillus niger* grew on SDA within 4 days, beginning as a white filamentous growth that soon developed into a black dotted surface as conidia were produced.On potassium hydroxide (KOH) preparation, both *Aspergillus flavus* and *Aspergillus niger* showed dichotomous branching (at 45°) of hyaline septate hyphae, 4 μm wide.

DISCUSSION

The results show that Ujemen village had the highest level (sum total of 208 μg/kg) of aflatoxin contaminated food items. Kulikuli (groundnut cake) with mean value of 38.3 μg/kg; was the most aflatoxin contaminated food item (Table 1), which is above the safe level of 20 μg/kg. The most prevalent fungal isolate was *Aspergillus flavus* with a total percentage of 81.7%, while *Aspergillus niger* had a total percentage of 18.3% (Table 2). This agrees with the work of Anderson *et al*., [1] in which who concluded that *Aspergillus flavus* is most predominant in Africa. Table 3 shows that there is a high level of aflatoxin contamination in groundnut and groundnut products. Comparism of the highest level of aflatoxin contamination in kulikuli and the least contaminated item (fowl feed) as shown in Table 1 was not statistically significant $\chi^2 = 1.035$; $P>0.05$. The lowest level of aflatoxin content was detected in fowl feed (mean value of 7.3 μg/kg) for the 6 villages may be due to the fact that most feed producing and feed-buying stations now abide by strict quality standards as documented by Adebayo and Idowu [15] when they worked on aflatoxin levels in food items in Ibadan, Nigeria.

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