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Investigation on the Occurrence of Ochratoxin A in Maize in Bangladesh

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Abstract

Maize was collected from different markets of Bangladesh for the determination of ochratoxin A. Simultaneously controlled maize samples were analyzed to assess the ochratoxin A level of market samples and that of controlled samples. A total of 120 samples were analyzed to determine ochratoxin A including 70 market samples and 50 controlled samples. Market samples were found containing a high contamination level of ochratoxin A ranged from 1 to 117 µg/kg and incidence rate was 40% whereas in the controlled samples the contamination rate was found very low ranged from 3 to 9 µg/kg and the incidence rate was found 10% only.

Key words : Maize, Ochratoxin A, Occurrence, Bangladesh, HPTLC

Introduction

Mycotoxins are secondary metabolites (by-products) produced by various generations of fungi when they grow on agricultural products before or after harvest or during transportation or storage. In general, they are differentiated between field and storage fungi.

Ochratoxin A, a naturally occurring mycotoxin, is produced by certain species of *Aspergillus* and *Penicillium* fungi. The natural occurrence of this toxin in grains and other plant products has been widely reported (Herwig and Scott, 1995; Kuiper- and Scott *et al.*, 1989; StErmer 1992). Feeding experimental diets containing ochratoxin A

have a deleterious effect on a number of animal species. Biological and biochemical effects associated with ochratoxin A include; teratogenicity, nephropathy, enhancement of lipid peroxidation, partial inhibition of ATP-dependent calcium uptake, carcinogenicity and inhibition of cell-mediated immune response (Kuiper and Scott 1989; Stærmer FC, 1992).

Human exposure to ochratoxin A can occur directly by consumption of contaminated plant derived food or indirectly by consumption of animal tissues from livestock exposed to contaminated materials (Petkova-Bocharova *et al*, 1988).

Bangladesh is a tropical and rainfall country. Recently, maize has been introduced as a good source of both food and feed. Although primarily produced as an ingredient of poultry feed, maize is increasingly being consumed as a human food.

The aim of this study was to evaluate the level of contamination of ochratoxin A in maize of Bangladesh and find out the ways of remedial measures.

Materials and Methods

Sampling

Samples collected for investigation were mainly of two types. One type was collected

from open market while the second type (controlled samples) was taken from the store (under specific condition) of Institute of Food Science & Technology (IFST), BCSIR, Dhaka. Open market samples were collected from different markets of the districts of Rajshahi, Khulna, Comilla and Dinajpur. Controlled samples were mainly the samples stored under required conditions by the IFST, BCSIR, Dhaka. Controlled samples were collected time to time from IFST.

Sample preparation

A 10 kg sample was collected in each lot from time to time from different markets and different stores. Each sample was sub-divided into 1 kg sub-sample in a rotary cascade sample divider and powdered in a sub-sampling mill by simple variable speed drive to collect 200 g representative sample.

The analytical methods employed solid phase extraction clean-up and quantification using HPTLC procedures specifically developed and validated for use in this study (Soares and Rodrigues, 1989).

Results and Discussion

During the one year study period a total of 120 samples were analyzed for ochratoxin A.

Samples collected from the markets of Rajshahi, Khulna, Comilla and Dinajpur districts showed the level of ochratoxin A ranged from 1-15 µg/kg, 1-103 µg/kg, and 1-117 µg/kg respectively (Table I).

tion of ochratoxin A. Only 5 samples out of 50 storage maize samples were found to be contaminated with ochratoxin A ranged between 3-9 µg/kg. Less moisture content was found in controlled stored samples. As a

Table I: Level of ochratoxin A and moisture content of market samples

Collection area	No. of samples analyzed	Level of moisture content (%)	No. of positive samples	Level of total ochratoxin A µg/kg
Rajshahi	20	11.51-17.85	8	1-78
Khulna	15	11.35-14.36	3	1-15
Comilla	15	10.15-18.70	6	1-103
Dinajpur	20	10.38-17.15	11	1-117

A total of 70 samples collected from different markets of four districts of Bangladesh showed that 28 samples were contaminated with ochratoxin A and incidence rate of 40% (Table II).

A total of 50 samples taken from different containers were analyzed for the determina

result of that ochratoxin A was not found in controlled stored samples (Table III).

Table IV shows that incidence rate of ochratoxin A of maize samples were found 30% in Tin, 0% in Motka, 0% in Dola, 20% in Jute Bag and 0% in controlled stored sample respectively.

Table II: Ochratoxin A incidence rate of market samples

Collection area	Samples analyzed	Ochratoxin A	
		Sample contaminated	Incidence rate (%)
Rajshahi	20	8	40
Khulna	15	3	20
Comilla	15	6	40
Dinajpur	20	11	55
Total	70	28	40

Table III : Ochratoxin A level and moisture content of stored samples of maize

Container type	No. of sample analyzed	Level of moisture content (%)	No. of positive samples	Level of ochratoxin A ($\mu\text{g}/\text{kg}$)
Tin	10	11.08-16.09	3	4-6-8
Motka	10	10.07-12.05	0	0
Dola	10	11.21-13.05	0	0
Jute Bag	10	12.51-14.05	2	3-9
Controlled stored samples	10	8.01-9.05	0	0

Table 4: Incidence rate of Ochratoxin A in controlled samples

Container type	No. of Samples analyzed	Ochratoxin A	
		Sample contaminated	Incidence rate (%)
Tin	10	3	30
Motka	10	0	0
Dola	10	0	0
Jute Bag	10	2	20
Controlled stored sample	10	0	0
Total	50	5	10

It is clear that the instructed material of the stored container has an influence of ochratoxin A contamination. Out of 10 samples taken from the containers only 3 samples were found to contain 4 $\mu\text{g}/\text{kg}$, 6 $\mu\text{g}/\text{kg}$ and 8 $\mu\text{g}/\text{kg}$ ochratoxin A respectively.

Conclusion

Incidence rate of ochratoxin A in stored sample is very low comparing to market sample.

A total of only 5 samples out of 50 samples were found contaminated by ochratoxin A. The incidence rate of ochratoxin A was found 10% in stored samples whereas the incidence rate of market samples was found to be 40%.

Proper storage is necessary to overcome the contamination of ochratoxin A in maize.

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