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Screening of Various Raw Food Commodities for Aflatoxin Contamination. *Part-II*

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Aflatoxin contamination of various raw foods arises when a toxin-producing strain, *Aspergillus flavus*, grows on substrates in areas where suitable environmental conditions are present for the development of the mould. The mould develops on substrates high in carbohydrate content [1] and can sustain a wide temperature range. Agricultural commodities and their products are thus easily vulnerable to aflatoxin contamination. It is reported that aflatoxins possess mutagenic, carcinogenic and tertogenic effects in a wide range of organisms [2]. They have been implicated in primary liver cancer [3] and in the acute Reye's syndrome [4,5] in humans with high mortality rate.

In our previous study [6] high incidence of aflatoxin (B_1 and B_2) contamination was observed in some agricultural commodities, particularly maize (*Zea mays*) and red pepper (*Capsicum annum*), harvested from the districts of Punjab, NWFP and sindh, A follow-up screening investigation based on an extensive survey of the problem areas was then conducted during the crop production period of 1987-1990. The objective of the this study was to determine the current status of the aflatoxin contamination problem in two food commodities so that future trends and control strategies could be evolved by relevent health authorities.

Eighty one samples of maize and twenty two of pepper were screened for aflatoxin B_1 and B_2 contamination. The samples were procured from the relevant local markets and farms of the districts of Multan, Bahawalpur, Sargodha, Peshawar, D.I. Khan and Sukkhar, belonging to the province of Punjab, NWFP and Sindh. The samples were composed at divisional level as in the previous study, taking care that the products were cultivated in the sampling area. Equal amount of each commodity (1 kg) was mixed to produce a single representative sample. Fourteen composite samples were prepared for maize and three for pepper. After removing extraneous matter, the samples were ground in a Christy and Norris hammer mill to 100 mesh. A separate portion of the samples was used for moisture determination, while the remaining samples were stored in high density polythene bags at -20°C until analysed. The Romer method [7,8] was followed for the quantification [8]. Relevant details of the procedure are given in our earlier work [6]. Recovery of the aflatoxin by the standard addition method ranged between 97-101%. Each estimation was performed in triplicate. Aflatoxin reference standards were obtained from Rijiks institute vwr volkgezondeheit, Bilthoven, Netherland.

The data on % moisture and concentration of aflatoxin are given in Table 1. The precision of the reported average concentration values for triplicate runs of a given sample was better than ±1.5%. The results presented in the table showed that about 30% of the maize samples from Punjab were aflatoxin B_1 contaminated, whereas the incidence of contamination of the maize from NWFP and Sindh stood at about 7%. The concentration of aflatoxin in the Punjab maize ranged from 35.2 to 65.2 μg/kg, for NWFP and Sindh the respective ranges were 10.9 - 30.6 and 40.3 μg/kg. In consequence, the problem of B_1 contamination was found to be of lower degree in NWFP and Sindh while Punjab emerged as a problem area for maize contamination. The incidence of almost 100% B_1 contamination in Punjab maize is alarming since B_1 is more toxic than B_2 [10]. In case of pepper, the observed range of B_1 was from 32.2 to 48.1 μg/Kg. The % incidence in this case compared well with the same average moisture contents.

Although an apparent reason for the observed high incidence of aflatoxin is the moisture content of the two food commodities, yet no mathematical corelation between aflatoxin concentration and moisture was found (Table 1). Nonethless, it is well known that the moisture content of agricultural produce favours the propagation of aflatoxin produced mould [11]. The situation is further aggravated during bulk storage under highly humid conditions. Lack of sample storage space, proper ventillation and general cleanliness were observed to be the key factors responsible for the contamination problem. Pre- and post-harvesting conditions were also found to be incosistent with international practice. A study carried out in Thailand supported this view. It was observed that a given lot of maize, originally containing no aflatoxin content during harvesting, acquired B_1 contamination during mechanical processing and subsequent storage [12]. In an other study a severe flavus infection was detected only in food stuff stored under highly humid conditions [13]. These observations, therefore reflect the importance of the moisture content towards aflatoxin contamination and need incorporation in the future contamination control programmes.

The severity of the aflatoxin contamination of local maize and pepper might be judged on the basis of world-wide re-

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TABLE 1. AFLATOXIN CONCENTRATION AND MOISTURE CONTENT OF MAIZE AND PEPPER FROM VARIOUS AREAS.

Food	Origin	Composites analyzed	Moisture (%)	Aflatoxin Level(μg/mg)	Aflatoxin Type
	Punjab				
Maize (Dry)	Multan	5	12.4	65.2*	B_1B_2
	Kabirwala	6	11.9	ND	-
	Khanawal	4	13.7	48.3	B_1
	Bahawalpur	4	14.9	ND	-
	Ahmedpur	5	13.2	ND	-
	Hasilpur	5	12.7	35.2	B_1
	Lodhran	7	12.7	ND	-
	NWFP				
	Peshawar	6	12.9	ND	-
	Nowshera	5	13.7	ND	-
	Akhora	5	14.0	30.6	B_1
	D.I.Khan	10	12.7	10.9	B_1
	Kulachi	5	13.2	ND	-
	Sindh				
	Sukkur	5	12.8	40.3	B_1
	Ghotki	5	13.2	ND	-
	Mirpur	4	13.6	ND	-
	Punjab				
Pepper (Dry)	Sargodha	6	13.8	48.1	B_1
	Shahpur	8	12.0	ND	-
	Bhawal	8	13.6	32.2	B1

ND = Not Detected: * = Pooled Value

ported incidences. The aflatoxin level in maize was recorded at 110.77μg/kg in Philippine, 93.0 μg/kg in Thailand, 53.0 μg/kg in Uganda and 18.0 μg/kg in the south eastern US. The European Economic Community (EEC) has set tolerence limit of 20-25 μg/Kg for aflatoxin [11]. Our results show that all the contaminated samples exceed the tolerence limit except for one sample of maize from NWFP. The products were thus unfit for human consumption on the basis of this evaluation. The ill effects of these commodities might not be obvious on a short-term basis, but they could eventually lead to ailments of varied types among the consumers. It is desirable that a regular aflatoxin monitoring program be initiated to assess the quality of the raw food and its contamination by aflatoxins. Further work in this direction is underway.

Key words: Aflatoxin analysis, Maize and pepper contamination with aflatoxin.

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