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OCCURRENCE OF AFLATOXIN IN SOME OF THE FOOD AND FEED IN NEPAL

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ABSTRACT

***BACKGROUND:** There are many contaminants like aflatoxin present in food products. Aflatoxin in comparison to many other contaminants is very toxic and also carcinogenic. There are reports of outbreak of aflatoxin toxicity in many parts of the world. **AIM:** To find out the level of aflatoxin in common food and feed. **SETTING:** The study was conducted in 16 districts of the Eastern region of Nepal. **METHODS AND MATERIALS:** Samples were collected from retailers and whole sellers from 1995 to 2003. Common food items that had high chances of infestation were collected. Food sample were taken to the laboratory to estimate the level of aflatoxin. The thin layer chromatography method was used to detect aflatoxin in the samples and comparison of fluorescence of sample spot with fluorescence of standard for estimation. **RESULT:** There were 832 samples for aflatoxin detection and estimation. One-third samples were found to be contaminated with aflatoxin. The highest percentage of contamination was found in peanut butter/vegetable oil (42.5%) and the lowest in areca nut (25%). Highest proportion of cornflakes samples were found to be contaminated with aflatoxin by more than the recommended value (30 ppb) and contamination in peanut was the lowest. **CONCLUSION:** People consume many common food items that contain aflatoxin. It is of high importance for the concerned department to give attention to this important public health issue. Even in small doses, continuous consumption can lead to many health problems. So it is of paramount importance to detect and control these contaminants in food items.*

***KEY WORDS:** aflatoxin; food; TLC*

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INTRODUCTION

Aflatoxins are a group of mycotoxins produced by certain fungi of *Aspergillus*'s family. Most mycotoxins do not affect humans. A few, such as aflatoxin, citrinin, luteoskyrin, patulin, penicillic acid, rugulosin, and sterigmatocystin are not only toxic but even carcinogic.[1] Aflatoxin B_1 is the most abundant aflatoxin and is considered to be the most toxic.[1] Aflatoxin affects liver causing cirrhosis, hepatoma, hepatitis, and Rey's disease as, well as affect other organs like kidney, myocardium, and muscles.[2] Even it may lead to decreased immunity in animal.[3] A study conducted among the Philippine people with liver cancer showed 440% higher consumption of aflatoxin as compared to controls.[4]

Time to time there has been outbreaks of aflatoxin toxicity caused by the consumption of moldy grain. A recent outbreak of jaundice due to aflatoxin toxicity occurred in Kenya. The mortality rate was as high as 39%.[5] The problem is more in this part of the world where there is no proper place to keep the grains dry for long time. It is very difficult to keep all foodstuff in airtight containers. In an outbreak, 106 people died and 291 showed symptoms of hepatic dysfunction after consumption of moldy maize.[6] Although liver, kidney, and muscles are commonly affected by aflatoxin, the brain is also affected. Autopsy of Thai children who died due to encephalopathy showed aflatoxin in their specimen.[7] There are reports of the presence of aflatoxin in the blood of people from Nepal, who consumed contaminated food and feed.[8] In a study, more than 11% children with kwashiorkor showed aflatoxin in their blood as compared to none of the controls.[9] It has been shown that the birth weight of the baby is also affected if mothers have taken aflatoxin in their food during pregnancy.[10] A strong negative correlation between aflatoxin and birth weight has also been observed.[11]

Apart from grains, nuts, butter and vegetable oil are also a source of this toxin.[12] Because grains and oils are frequently imported and exported from one country to other, there are chances of spreading of toxicity by these products. Nepal is a country with limited resources. So it needs import of these consumable items from different countries. This gives chances of storage of these items before distribution. There are few data available for common commodities from Nepal, which shows that mycotoxin are present in food and feed.[13],[14] The objective of this study is to confirm the presence of aflatoxin and its content in different food and feed in the Eastern region of Nepal.

MATERIAL AND METHOD

In Nepal, the Department of food technology and quality control is responsible for regular sampling and examining the level of these toxins in food and food products. The estimation of these toxins had been done on the food grown in Nepal, as well as food and food products imported from other countries. The food and feed that are mainly imported are peanut, raw material for vegetable oil (palm oil) and peanut butter. Samples were collected regularly to examine the extent of aflatoxin in food and food products in all 16 districts of Eastern Nepal from 1995 to 2003. Samples of food and feed were randomly collected under the surveillance system of the Department of

food technology and quality control to detect different types of food contaminants. This was not a prospective study. Data available for aflatoxin in food and feed were used for analysis. Owing to the unavailability of data, analysis as imported and nonimported food and feed could not be performed. Samples were collected from retailers as well as from whole sellers on regular basis. If there were reports of any outbreak or toxicity from any other source (different hospitals) then the samples collected from that area and if possible from particular source. Common food and food products like cereals, pulse, nuts, vegetable oil, and fat, etc., were collected for estimation. Detection and estimation for aflatoxin were done by using the thin layer chromatography method (TLC). Thin layer chromatography method is one of the commonest and widely used techniques to detect different types of food contaminants. Comparison of toxicity levels for aflatoxin was done by comparing fluorescence of sample spot with fluorescence of standard. A maximum value of 30 ppb was considered to classify the food items as contaminated more than the recommended level.[15] If the result was positive for any food item the report had been sent to the concerned authority to check the sale of that contaminated food items.

RESULTS

Altogether, there were 832 samples that were collected from 1995 to 2003. Although few of the food and feed were imported, majority were produced locally. Out of total samples more than half (52%) were cereal and pulses, and the rest (48%) were nuts, vegetable oil/butter. One-third samples (32.8%) were found to be contaminated with aflatoxin (B1 or B2). Peanut butter (42.5%) was leading the list of contaminated food item followed by peanut (34%), maize grit and flour (31.9%), and cornflakes (31.5%). Areca nut was the only food item having aflatoxin level less than the recommended value (30 ppb) [Table 1].

Eighteen percent (151) of the total sample were found to be contaminated with the aflatoxin level even more than 30 ppb (recommended value). It has been observed that the highest proportion of cornflakes samples (26.3%) were contaminated with aflatoxin level by more than 30 ppb among all food items. One-fourth sample of wheat flour was also contaminated with more than the recommended value followed by peanut, peanut butter/vegetable oil and maize grit/flour. The level of aflatoxin B1 was ranging from 54 to 1806 and that of B2 from 4 to 1560 among

Table 1: Food and food products contaminated with aflatoxin

Food items	*Contaminated*	*Not contaminated*	*Total number of samples*
Maize grit and flour	92 (31.9)	196 (68.1)	288
Peanut	68 (34.0)	132 (66.0)	200
Peanut butter/vegetable oil	43 (42.5)	58 (57.5)	101
Cornflakes	18 (31.5)	39 (68.5)	57
Wheat flour	32 (30.1)	74 (69.9)	106
Areca nut	20 (25.0)	60 (75.0)	80
Total	273 (32.8)	559 (67.2)	832 (100)

Figures in parentheses are percentages.

the samples. Peanut got the least proportion of contamination above the recommended level [Table 2].

DISCUSSION

Aflatoxin producing fungi infests food grains (i.e., maize, groundnuts, wheat, etc.) or other food items usually during storage. Among all toxins (B1, B2, B3, G, etc.), B1 is the most important and toxic to human beings from the public health point of view.[1] There are reports of outbreak and mass causalities caused by aflatoxin in different parts of the world.[4] Aflatoxin not only gives rise to cases of poisoning but is also associated with cancer (liver), kwashiorkor, and growth retardation among children.[9],[16],[17] Aflatoxin contaminated food and feed have been reported from all parts of the world. Sera from patients and workers in Nepal have been found positive suggesting the consumption of aflatoxin.[8] Owing to the lack of resources and government policy, detection of aflatoxin in blood could not be done in the present study. In Nepal, not only aflatoxin producing fungi but other fungi like *Fusarium* has also been reported in grains.[18]

Maize and wheat are the staple food in Nepal and are grown here. Although rice is also consumed in large quantities, it is seen that milled rice in Asian countries usually contains no or very low aflatoxin.[14] There is lack of proper storage facility and so there is a chance of the rice getting infected with *Aspergillum*. The seasonal temperature and humidity accelerates the growth. It is seen that 22% of maize samples from foothills of the Nepal Himalayan mountain contains mycotoxin.[18] Countries with similar climatic conditions experience the same problem. This study demonstrated that peanut, its product, and maize were the main items contaminated with aflatoxin. It has also been found that African countries experienced these problems frequently in peanuts and maize.[19] It is observed that one third samples of maize and its products were infested, and 20% of them showed the level of aflatoxin to be more than the recommended value. Survey conducted in Nigeria showed only slightly higher percentage of contamination in maize and its products.[20] Contrary to the present study, which showed cereals, nuts, and oil contaminated (more than recommended value) with aflatoxin, developed countries also showed contamination in the same food items but below the recommended value.[21] The reason for this may be the because of the better storage facilities and proper screening and regular monitoring for these contaminants

Table 2: Food and food products containing aflatoxin more than recommended level

Food commodity	*Proportion (%) of sample having aflatoxin >30 ppb (number)*	*Range of aflatoxin B1 detected*
Maize grit and flour	19.7 (57)	64–859
Peanut	16.0 (32)	54–1806
Peanut butter/vegetable oil	19.8 (20)	64–1736
Corn flakes	26.3 (15)	60–163
Wheat flour	25.4 (27)	109–693
Total	151*	

* Eighteen percent of total sample.

in those countries.

In comparison to developed countries, the third world has limited resources and the surveillance system thereby leading to chances of getting more contaminated food and food products. It was observed that the level of aflatoxin in maize was ranging from 47 to 859 ppb. This finding is supported by another study from Bangladesh where aflatoxin was ranging from 33 to 480 ppb.[22] When peanut and its products were analyzed for aflatoxin, 36% contained more than the recommended level of aflatoxin.[19]

Food items stored for a long time before its distribution are prone to get contaminated with aflatoxin. On the other hand, toxins can also be transferred to the food products from its raw food. There are centers for food safety, which work to protect human health and the environment by curbing the proliferation of harmful food production technologies, and by promoting organic and other forms of sustainable agriculture.

For the future course of action, to reduce contamination, it is necessary to introduce a system to check this problem. Mould inhibitor can be used for effective conservation and control of aflatoxin production. This can be done along with the education to the farmers, grain handlers, and marketing people for exchanging safety and minimizing loss. Use of heat treatment for decontamination of aflatoxin in food is also another way to control. To conclude, contamination of commonly used food and feed is an important unrecognized risk to public health and can have long-term health implications.

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