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Original Research Article

Prevalence of aflatoxin contamination in groundnuts in Pune city

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ABSTRACT

Background: Aflatoxin contamination in groundnuts is caused by the fungi *Aspergillus flavus* and *Aspergillus parasiticus*. In this study, the prevalence of aflatoxin B1 in groundnuts has been assessed. Aflatoxins are highly carcinogenic, mutagenic and teratogenic. They are known to cause hepatocellular toxicity. The aim of the study is to estimate prevalence of aflatoxin contamination in groundnuts sold in the city of Pune and to assess the awareness about aflatoxin contamination amongst shopkeepers of selected shops/vendors.
Methods: Sampling of groundnuts was conducted in 17 out of 144 administrative wards of Pune city. Hundred samples weighing 250g each were purchased from the randomly selected stores and transported in black polythene bags to The State Public Health Laboratory, Pune. Thin layer chromatography (TLC) was used by the laboratory to determine levels of aflatoxin B1. A pre-structured questionnaire was used for assessment of knowledge of aflatoxin contamination amongst vendors.
Results: Out of 100 samples, four samples were contaminated with aflatoxin. However the maximum contamination was 0.6 parts per billion, which is well within the permissible limit of 30 parts per billion. Awareness of aflatoxin contamination amongst vendors was six percent. Ninety four percent of vendors were unaware of the concept of aflatoxin contamination.
Conclusions: It is necessary to educate vendors, suppliers and handlers about the health hazards caused by this toxic fungus for the benefit of the average consumer.

Keywords: Aflatoxin, Groundnuts, Pune, Contaminatoin

INTRODUCTION

Aflatoxin contamination in groundnut is a widespread and serious problem in most groundnut producing countries where the crop is grown under rain-fed conditions. It affects crop productivity and makes the produce unfit for consumption, as toxins are injurious to health.

The aflatoxin-producing fungi, *Aspergillus flavus* and *A. parasiticus*, can invade groundnut seed in the field during harvest, transport and storage.[1] However, India being a tropical and moreover a developing country faces the issue of aflatoxin contamination even though the Indian aflatoxin regulation level=30 parts per billion.[2]

In 2015 the world health organization (WHO) decided to target food safety on world health day (April 7th).[3]

Our food supply is becoming more globalized, therefore strengthening food safety systems is a necessity.

The WHO is promoting efforts to improve food safety. The need to create awareness amongst the layman is of

utmost importance. Several studies of aflatoxin contamination of groundnut in different part of India showed varied prevalence.[4] Hence the study was planned to estimate prevalence of Aflatoxin contamination in groundnuts sold in the city of Pune, Maharashtra and also to assess the level of awareness about Aflatoxin contamination amongst vendors.

METHODS

A cross sectional study was planned in randomly selected 17 wards out of 144 electoral wards of the PMC.[5] Ethics committee approval was obtained prior to commencement of the study.

The study was conducted in the monsoon season from 1st August to 30th September 2015.

Total sample size calculated was 100. Considering the prevalence of aflatoxin contamination as 16%.[4] Small-scale grocery stores and supermarkets from the randomly selected wards of Pune city were included. Small-scale groceries and supermarkets from other wards (i.e., apart from the selected wards) were excluded. Thus, randomly selected 95 small grocery shops and 5 large supermarkets from 17 wards were included in the study.

Samples weighing 250 g of groundnuts were purchased from each vendor/store and transported to the laboratory in black colored polythene bags (as aflatoxin is UV sensitive) in order to protect it from direct sunlight. The samples were labeled with a number corresponding to the details of each store, including the name, type of store, location, storage method and their stock of groundnuts (in kg) bought per month.

Samples were analyzed at The Public Health Laboratory, Pune Cantonment, Water Works Compound, Stevely Road, Near Bishops School, Camp, Opp. St. Mary's School, Pune-411001.The Government of India has notified the State Public Health Laboratory as the Central Food Laboratory and it participates in various food analysis investigations and collaborative work with other institutions.

Thin layer chromatography (TLC) was used by the laboratory to determine levels of Aflatoxin B1.

The reports from the lab were collected and the data was analyzed using Microsoft Excel. Levels of contamination in the samples, which tested positive for Aflatoxin B1, were compared with national standard of 30 ppb.

Percentage of samples having contamination gave the estimate of prevalence.

Assessment of awareness of vendors was done after purchasing the required sample with the help of pre-structured, pilot tested questionnaire. They were questioned on knowledge about aflatoxin contamination in groundnuts, associated health hazards and measures taken by them to prevent contamination.

RESULTS

The data collection was done in the monsoon season, as moisture content is relatively higher at this time, which causes fungal growth.

Aflatoxin contamination was present in 4% of the samples collected (Figure 1). However the maximum contamination was 0.6 parts per billion, which is well within the permissible limit of 30 parts per billion. The minimum contamination was 0.125 ppb as seen in Table 1.

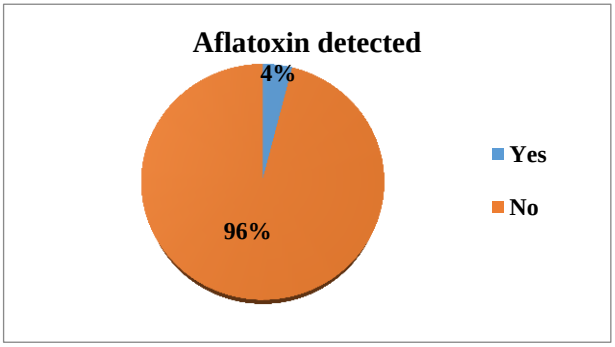

Figure 1: Percentage of samples contaminated with aflatoxin B1.

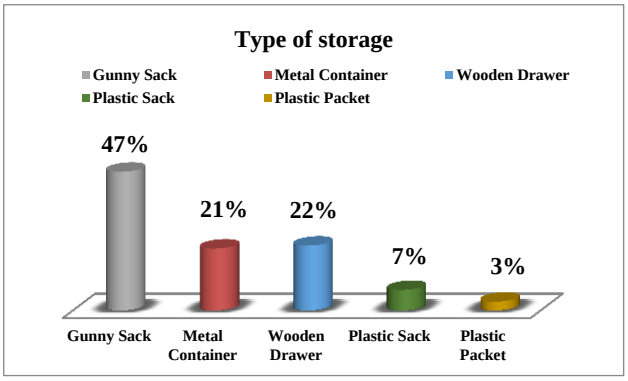

Figure 2: Type of storage used for groundnuts by selected stores.

Figure 2 depicts the different types of storage methods used in the stores. Gunnysacks were most commonly used whereas individual plastic packaging was the least common method of storage. Out of four contaminated samples two samples were stored in wooden drawers: one was in a plastic sac and one in a gunny bag (Table 1).

On comparing large supermarkets and small groceries for samples contaminated with Aflatoxin, all four contaminated samples were from small scale groceries. Out of the four contaminated samples, three were from small scale groceries located in the same ward (Table 1).

Table 1: Method of storage of contaminated samples.

Sample no.	Ward no.	Type of store	Method of storage	Level of contamination (ppb)
44	40	Small scale grocery	Wooden drawer	0.6
48	40	Small scale grocery	Wooden drawer	0.14
50	40	Small scale grocery	Plastic sack	0.2
62	111	Small scale grocery	Gunny sack	0.125

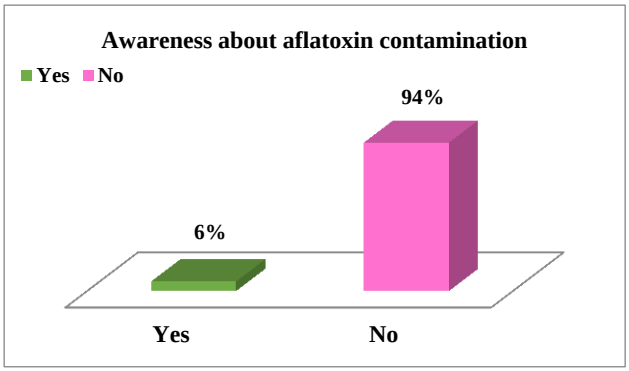

Figure 3: Awareness about aflatoxin contamination in groundnut among selected vendors.

The awareness amongst vendors about Aflatoxin contamination was only 6% (Figure 3).

DISCUSSION

Many studies about aflatoxin contamination in groundnut kernels have proved that it is a commonly occurring toxic agent, which the layman needs to be made aware of.[4]

The current permissible limit for aflatoxin levels in India is 30ppb.[2] This study has shown that in Pune out of the 100 samples tested, only 4% of samples tested positive and in these, the contamination level was a maximum of 0.6ppb. Similar studies conducted in India have shown varying results.

In a study conducted by Reddy et al in Anantapur district in 4 rainy seasons revealed that 90% of samples were contaminated.[6] This could have been due to heavy rainfall and high moisture content, which facilitated growth of the fungi. In the year 2015 when the project was conducted, Pune experienced unusually less rainfall and relative humidity, which may have attributed to the very low levels of contamination. In the same study by Reddy et al a high level of aflatoxin was observed in 9.7% of samples, however in the present study the level of aflatoxin in the 4% of samples that tested positive, was very low (0.125-0.6 ppb) which was within the permissible limit. Various other groundnut aflatoxin prevalence studies had a much higher % prevalence compared to the 4% prevalence in the present study.

An undertaking by the Indian Council for Medical Research which, used samples from different states revealed that out of the 2062 samples collected, 433 samples i.e., 21% were contaminated with aflatoxin B1 above the level of 30ppb.[7] In the current study, samples were collected only from Pune and better storage and distribution system along with less humidity may have helped in reducing growth of fungus thereby giving a lower incidence of prevalence. In a study conducted by Dr. Peter Craufurd, out of 25 samples, 7 samples, (i.e., 28%) were contaminated below the permissible limit and 2 samples, (i.e., 8%) were contaminated above the permissible limit.[8]

In a survey conducted by Navya et al, 38 groundnut samples were collected from various sources. All the samples were found to be contaminated and the incidence of contamination ranged from 2 to 50% with levels upto 28ppb.[9] In this study, prevalence of aflatoxin B1 and B2 was estimated whereas in the present study, only levels of aflatoxin B1 were estimated. Hence, the % prevalence might have been lower.

Reddy et al in their review article have discussed the problem of aflatoxin contamination in India and have concluded that it is due to poor harvesting practices, high temperature, high moisture levels and improper post-harvest practices which results in fungal growth, proliferation and aflatoxin contamination.[10] As the prevalence in this study was only 4% it can be credited to good harvesting practices and proper transportation from farm to stores as well as favourable storage facilities.

Kumar et al estimated prevalence of aflatoxin contamination in groundnut in Tumkur district of Karnataka. Their research revealed that all of the 42 market samples collected were contaminated however the levels were below 20ppb, which is within the acceptable limit.[4] Similarly in the present study out of 100 market samples, only 4 samples were contaminated. The minimum contamination level was 0.125ppb and the maximum was 0.6ppb. This can be attributed to proper storage of market samples in the wholesale markets as well as in the groceries. Out of the 4 contaminated samples, 3 were from the same ward i.e., ward no. 40. This may be due to a common supplier/ wholesale market from where the monthly stock is purchased. Therefore, this distributor maybe the root cause of contamination. Two samples out of the four that were contaminated were stored in wooden drawers, which might have increased absorption of moisture, facilitating growth of *A. flavus*.

All samples purchased from large supermarkets were free from contamination and aflatoxin B1 was present only in

samples from small-scale groceries. This shows that the storage and handling along with source of product from supermarkets is of a higher/better standard as compared to the groceries. It was noticed that in these large stores, the samples were individually packaged in separate plastic packets, which protected them from moisture and contamination.

Awareness about aflatoxin contamination was very less (6%). This could be due to lack of education in majority of the vendors from whom samples were collected. There is insufficient media coverage about this issue and the community is unaware of this health risk.

CONCLUSION

This study has concluded that out of 100 samples of groundnut kernels, the prevalence of aflatoxin contamination in Pune city is only 4%, despite carrying out sampling in the monsoon season. Low prevalence indicates that the distribution and storage facilities for groundnuts in the city of Pune are satisfactory. Large supermarkets have better storage and handling facilities, which prevent occurrence of aflatoxin contamination.

The most concerning finding of the study was that awareness among vendors from whom samples were purchased was only 6%. Hence there is a need to spread awareness about health hazards of aflatoxin and to promote methods that will prevent contamination by educating vendors about proper storage and handling so that the incidence can further be reduced.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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