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Survey on aflatoxin awareness and assessment of Pune district of Maharashtra, India

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ABSTRACT

The survey on Aflatoxin Awareness And Assessment of Pune District of Maharashtra (India), was carried out during the year 2013-14 to create awareness among the people and assessment of it through questionnaire method. A questionnaire of fifteen different questions was prepared. In this survey study, data was collected from twelve different villages of three taluka Baramati, Daund and Indapur of Pune district. Total one hundred twenty six questionnaires sheet were sorted village wise and pulled data information about aflatoxin awareness and assessment is done. Among these twelve villages 85 questionnaires were collected from six villages of Baramati taluka Baramati 14, Dorlewadi 40, Dhekalwadi 19, Jalgaon 6 and 3 each from Malad and Sonawadi. Fifteen questionnaires were collected from four different villages of Daund taluka, Goragade1, Jiregaon 8, and 3 each from Jadhavwadi and Wasunde. Twenty six questionnaires were collected from only two villages Sapkalwadi and Sanjaynagar of Indapur taluka which stands for 15 and 11 questionnaries respectively. Out of 126 individuals answered maximum 57 persons (i.e.45%) were S.S.C., 26 individual (21%) were H.S.C.,15 individual (12%) each were found graduate and post graduate, only 13 individuals i.e. 10 % were belongs to other educational qualifications. In the occupation status it has been observed that 38 i. e. 30% were engaged in service, in business it was16 (13%), in agriculture it was maximum 65 (52%) and least7 (5%) was engaged in other occupation. In the consumption of oil it was found 53 (i. e. 42%) family consumed less than 5 Kg. or 5 Kg. of oil per month and 73 (i. e. 58%) consumed more than 5 Kg. of oil per month. The detailed value of minimum consumption of oil per individual per month is found in between 820 gm to 1 Kg. and for maximum it is 2.870 Kg.The data for family members indicates 66 families 52% are there which have 5 or less than 5 members per family and 60 families 48% have more than 5 members in the family. Maximum families 76 (60%) used soybean oil, 35 families i.e. 28% consumed groundnut, 12 families i.e.10% purchased sunflower oil and only 2% i.e. 3 families found consuming cotton oil. In adulteration of oil out of 126 individuals 60 i.e.48% were aware and remaining 66 i.e.52% individual were unaware about this. They were made aware and insisted them to purchase good quality oil for better health. To know the purchasing level of the individual the data was collected in three categories i.e. branded, local and in loose type of oil purchased by the consumers. It has been observed that 80 families 63% purchased branded company oil, 30 (24%) families utilized local brand oil whereas only 16 families 13% found using loose type of oil. An effort was made to find out the reason behind using branded oil, it has been found that 66 individuals i.e.52% families used it because it is pure and tasty and remaining 60 families 48% have replied for different reasons behind using branded oil. In the reason behind purchasing local company oil 13 individuals (i.e.10%) have answered for getting it cheaper and easily available compared to that of the branded one, the remaining 113 (i.e.90 %) have replied that there are other reasons besides these to purchase local company oil. The information was collected about the physical fitness of the people, it has been observed that among the 126 individuals answered 107 (85%) were found physically sound and 19 i.e.15% were suffering from common problems like stomach aching, leg and body pain, kidney stone ,blood pressure ,backbone problems ,piles, arthritis ,heart and diabetes but no one was

found suffering from cancer or oncogenic problems. For storing groundnut for domestic purpose data was collected on different types of storing appliances used by the local village people and it has been observed that maximum people 64 (i.e.51%) used plastic gunny bags, 28 (22%) used plastic container, 20 (16%) used aluminium tin to store groundnut pods and remaining only 14 (11%) individuals used to keep it open temporarily before consumption. The data was collected to know the awareness among the people about aflatoxin it has been observed that out of 126 individual only 18 i.e.14% were aware about the aflatoxin and the remaining 108 i.e.86% were unaware about it. These unaware 86% individuals were made aware about aflatoxin during collecting information at the time of survey conducted. An effort was made to know if the consumer is aware about the toxin, other than aflatoxin for this awareness it is found that out of 126 individuals 40 (32%) have replied yes and remaining 86 (68%) individuals were found unaware, and these 68% unaware individuals were made aware about other toxin during collecting information at the time of survey conducted.

Key words: *Aspergillus flavus*, aflatoxins, groundnut, mycotoxins, survey

INTRODUCTION

Mycotoxins (mykos = of fungal origin; toxikoses =toxins) are toxic substances produced mostly as secondary metabolites produced by fungi that grow on seeds and feed in the field, or in storage. The term 'mycotoxin' is usually reserved for the toxic chemical products produced by fungi that readily colonize crops [1]. One mold species may produce many different mycotoxins, and the same mycotoxin may be produced by several species [2]. The symptoms of a mycotoxicosis depend on the type of mycotoxin; the concentration and length of exposure; as well as age, health, and sex of the exposed individual [3]. Aflatoxins are a type of mycotoxin produced by *Aspergillus* species of fungi, such as *A.flavus* and *A.parasiticus* [4a]. The umbrella term aflatoxin refers to four different types of mycotoxins produced, which are B_1, B_2, G_1, and G_2 [5a]. Aflatoxin B_1, the most toxic, is a potent carcinogen and has been directly correlated to adverse health effects, such as liver cancer, in many animal species [4b]. Aflatoxins are largely associated with commodities produced in the tropic and subtropic, such as cotton, peanut, spices and maize [4c, 5b]. The occurrence of mycotoxins in agricultural commodities is a major health concern for livestock and humans. Aflatoxins are the secondary metabolites of the fungi namely, *Aspergillus flavus* and *A. parasiticus*. Aflatoxins are further differentiated into sub types such as B1, B2, G1, G2 because of their blue (B) and green (G) fluorescence under ultraviolet light respectively, based on structure, chromatographic and fluorescent characteristics. Aflatoxins are extremely toxic secondary metabolites produced predominantly by certain strains of *A.flavus* and *A.parasiticus*, and rarely by *A.nomius*. Chemically, they are difuranocoumarin derivatives produced by polyketide pathway. There are about twenty related secondary forms of aflatoxins, aflatoxin B1,B2,G1and G2 frequently contaminate the foods (6,7) and their toxicity has been well documented world over and from India (8a,8b,9,10). These fungi can infect the crop in the field, or the produce during the processing, handling, storage. On the infected pods, kernels or in the culture, the fungus produced olive green coloured colonies with abundant sporulation, the accumulation of the aflatoxins occurs in the kernels or feed. Both raw and processed fruits and vegetables are highly susceptible to mycotoxin contamination [11].*A. flavus* is often countered as a tomato fruit rot pathogen during post harvest survey [12]. Aflatoxins are potent carcinogenic substance and have also been implicated in human diseases like hepatitis B, tuberculosis by suppressing immune system. Spores of *A. flavus* are saprophytic in nature and once they become pathogenic,they are known to produce an array of toxic secondary metabolites including aflatoxins[13].Aflatoxin B1(AFB1)is a potent hepatocarcinogenic and genotoxigenic metabolites that have been classified as group I carcinogens by International Agency of Research on Cancer [14].In our earlier surveyed carried out for awareness and assessment for aflatoxin of Muktainagar Taluka in Jalgaon district of Maharashtra it has been observed that only 36% individual were found aware about the aflatoxin and 64% were unaware about it and for other toxin 48% were aware and 52% were unaware [15]. In our next surveyed carried out for Malkapur Taluka in Buldhana district of Maharashtra the data collected on awareness about aflatoxin which indicates that 60% individuals were aware about the aflatoxin and 40% were found unaware about it.62% consumers were aware about the toxin, other than aflatoxin and 38% were unaware about this (16).Thus, aflatoxins have become of concern in agriculture as well as in animal and human health on a global scale.

Three basic approaches viz, prevention, removal and detoxification seem to be promising for aflatoxins control. Use of crop rotation and intercropping found useful in preventing aflatoxins contamination [17].Addition of calcium and gypsum also reduce pre-harvest aflatoxin contamination [18].Use of resistance genotype like Chitra [19],PI-337409[20] and other bold seeded genotype like ICG-239, B-95, B-99-1 supported to lowest aflatoxin production

[21] are useful in resistance breeding programme. Simple methods like exposure of oil to bright sunlight, use of common salt (10%) are useful even at household level for detoxification of aflatoxin [22].

The different factors responsible for aflatoxin contamination at different level are catagories as pre –harvest level i.e.at soil level -native population of *A. flavus* group of fungi varies from farm to farm depending on soil types and crop rotations. At plant level-drought prone sandy soil in which groundnut is grown year after year are hot spots for aflatoxin contamination. Prolonged drought 3-4 week during seed formation and maturation stages triggers aflatoxin contamination.

Harvesting level-Mechanical damage to the pods at the time of harvesting, threshing or damaging testa during the process of decortications. Harvesting of crop immediately after irrigation and consequent high initial pod moisture at the time of processing and storage promote condition for aflatoxin build up in the produce. Inefficient and slow drying process under the humid condition enhances aflatoxin contamination risk greatly. Post harvest level (storage level) –storage of produce in warm and humid room with a large stack directly on the floor favours rapid multiplication of the fungus and affects even good lots.

MATERIALS AND METHODS

To conduct survey on aflatoxin awareness and assessment a questionnaire of fifteen different questions was prepared. The questions were related with their qualification, occupation, number of members in the family, whether they have previous knowledge of aflatoxin contamination in groundnut and other related toxins produced due to adulteration in consumable food items. Quantitiwise and qualitywise monthly utilization of edible oil by the family. reason behind the utilization of branded and local product of edible oil, physical fitness, use of different means like gunny bag , plastic container, aluminium tin or the open space for storing groundnut.

This survey of three talukas Baramati, Daund and Indapur of Pune district was carried out during the year 2013-14 and data was collected personally from the individuals. The main concept behind this survey was to compare difference in the information collected from our previous survey carried out for Muktainagar taluka of Jalgaon and Malkapur taluka of Buldana district and to create more awareness among the individuals of above mentioned three talukas of Pune district about aflatoxin and other food related toxin. Here, in this survey study, data was collected from different villages of these three talukas of Pune district of Maharashtra. The total twelve different villages were covered in this survey and one hundred twenty six questionnaires were collected from different individuals, the details of which are given in the table. All these one hundred twenty six questionnaires were sorted village wise and detailed data information about aflatoxin awareness and assessment is done.

RESULTS AND DISCUSSION

The data in the Table 1 indicates, village wise distribution of 126 questionnaires collected, from three different talukas Baramati, Daund and Indapur of Pune district's of Maharashtra. Total twelve villages were covered to collect data among these twelve villages 85 questionnaires were collected from six villages of Baramati taluka which includes (Baramati 14, Dorlewadi 40, Dhekalwadi 19, Jalgaon 6 and 3 each from Malad and Sonawadi. Fifteen questionnaires were collected from four different villages of Daund taluka which includes Goragade 1, Jiregaon 8, and 3 each from Jadhavwadi and Wasunde. Twenty six questionnaires were collected from only two villages Sapkalwadi and Sanjaynagar of Indapur taluka which stands for 15 and 11 questionnaries respectively.

Table 1. Number of questionnaires collected from three different Talukas of Pune District of Maharashtra

Sr. No.	Village Name with Taluka	No. of questionnaires	Sr. No.	Village Name with Taluka	No. of questionnaires
1	Baramati (Baramati)	14	7	Goragade (Daund)	01
2	Dorlewadi (Baramati)	40	8	Jiregaon (Daund)	08
3	Dhekalwadi (Baramati)	19	9	Jadhavwadi (Daund)	03
4	Jalgaon (Baramati)	06	10	Wasunde (Daund)	03
5	Malad (Baramati)	03	11	Sapkalwadi (Indapur)	15
6	Sonawadi (Baramati)	03	12	Sanjaynagar (Indapur)	11
-	**Tatal**	**85**	-	**Total**	**41**

The data in the Table 2 illustrate about two parameter educational qualification and occupation of the individuals surveyed. The parameter educational qualification was added in the questionnaires to know about the civilized

status of the people and it has been observed that among the 126 individuals answered maximum 57 persons (i.e.45%) were S.S.C., 26 individual (21%) were H.S.C., 15 individual (12%) each were found graduate and post graduate ,only 13 individuals i.e. 10% were belongs to other educational qualifications. In the occupation status it has been observed that out of 126, 38 i. e. 30% were engaged in service, in business it was 16 (13%), in agriculture it was maximum 65(52%) and least7 (5%) was engaged in other occupation.

Table2. Parameter wise data collected from 126 questionnaires

Sr. No.	Educational Qualification	No. of Individual	Percentage over total	Sr. No.	Occupation	No. of Individual	Percentage over total
1	S.S.C.	57	45	1	Service	38	30
2	H.S.C.	26	21	2	Business	16	13
3	Graduate	15	12	3	Agriculturist	65	52
4	Post Graduate	15	12	4	Other	07	05
5	Other	13	10	-	-	-	-
-	**Total**	**126**	**100**		**Total**	**126**	**100**

The result obtained for other parameters like family members, rate of oil consumption per month, type of oil consumed, adulteration in oil, purchase of oil, reason behind using branded and local company oil, physical fitness, storing facility for groundnut, and awareness of the people about aflatoxin and other toxin in groundnut is shown in the Table 3.

To determine the rate of oil consumption per family per month, the rate of oil consumption was categories in two i.e. in type first family consuming 5Kg. or less than 5 Kg. of oil was included and in type second family consuming more than 5 Kg. of oil was incorporated. The results in the Table 3 shows that among the 126 individuals 53 (i. e. 42%) family consumed less than 5 Kg. or 5 Kg. of oil per month and 73 (i. e. 58%) family consumed more than 5 Kg. of oil per month. If we have compared this data of rate of oil consumption per month with that of family members, this indicates that 66 families 52% are there which have 5 or less than 5 members in the family and 60 families 48% have more than 5 members in the family. The detailed value of minimum consumption of oil per individual per month is found in between 820 gm to 1 Kg. and for maximum it is 2.870 Kg. The information was collected on type of oil consumed by the consumer and it has been observed that out of 126 the maximum families 76 (60%) used soybean oil, 35 families i.e. 28% consumed groundnut,12 families i.e.10% purchased sunflower oil and only 2% i.e. 3 families found consuming cotton oil.

Now a days some agencies knowingly or unknowingly sometime are doing adulteration in oil to profit more money without considering about the health of the consumer. So, to make consumer more alert about adulteration they were questioned whether they are aware about this or not the answer was collected in yes or no form. Data in table3 indicates that out of 126 individuals 60 i.e.48% were aware and remaining 66 i.e.52% individual were unaware about this. They were made aware and insisted them to purchase good quality oil for better health. To know the purchasing level of the individual the data was collected in three categories i.e. branded, local and in loose type of oil purchased by the consumers. It has been observed that 80 families 63% purchased branded company oil, 30 (24%) families utilized local brand oil whereas only 16 families 13% found using loose type of oil.

Those who were using branded oil for culinary purpose an effort was made to find out the reason behind using branded oil, it has been found that out of 126 individuals 66 i.e.52% families used it because it is pure and tasty and remaining 60 families 48% have replied for different reasons behind using branded oil i. e. it is good and fit for health, there is no contamination and side effect and it is too nutritious to consumed.

In the reason behind purchasing local company oil13 individuals (i.e.10%) have answered for getting it cheaper and easily available compared to that of the branded one, the remaining 113 (i.e. 90 %) have replied that there are other reasons besides these to purchase local company oil. The common reasons for purchasing local company oil over the branded were saving of money, scarcity of money, economically reasonable and poor purchasing capacity of the consumers.

The information was collected about the physical fitness of the people, the main concept behind this was to know about what are the common physical problems among them and could we find out any comparison with their life style. It has been observed that among the126 individuals answered 107 (85%) were found physically sound and only 19 i.e.15% were suffering from common health problems like stomach aching, leg and body pain, kidney stone

,blood pressure ,backbone problems ,piles, arthritis, heart and diabetes but no one was found suffering from cancer or oncogenic problems and so we could not found any relationship with their health problems with that of their type of oil consumed.

Table 3.Parameter wise data collected from 126 questionnaires.

1	Family Members	5 or less than 5	66	(52%)
		Greater than 5	60	(48%)
2	Rate of Oil Consumption per month	5 or less than 5 Kg.	53	(42%)
		Greater than 5 Kg.	73	(58%)
3	Type of Oil Consumed	Groundnut	35	(28%)
		Soybean	76	(60%)
		Cotton	03	(02%)
		Sunflower	12	(10%)
4	Adulteration in Oil	Yes	60	(48%)
		No	66	(52%)
5	Purchase of Oil	Branded company	80	(63%)
		Local company	30	(24%)
		Loose	16	(13%)
6	Reason behind using branded company oil	Pure	66	(52%)
		Other	60	(48%)
7	Reason behind using local company oil	Cheaper/easily available	13	(10%)
		Other	113	(90%)
8	Physical Fitness	Yes	19	(15%)
		No	107	(85%)
9	Storing Facility	Plastic gunny bag	64	(51%)
		Plastic container	28	(22%)
		Aluminium tin	20	(16%)
		Open space	14	(11%)
10	Awareness about Aflatoxin	Yes	18	(14%)
		No	108	(86%)
11	Awareness about other toxin	Yes	40	(32%)
		No	86	(68%)

For storing groundnut while using for domestic purpose data was collected on different types of storing appliances or alternatives used by the local village people. It has been observed that among 126 people maximum people 64 (i.e.51%) used plastic gunny bags, 28 (22%) used plastic container, 20 (16%) used aluminium tin to store groundnut pods and remaining only 14 (11%) individuals used to keep it open temporarily before consumption.

To know the awareness among the people about aflatoxin which was the main concept of this survey from the data collected it is found that out of 126 individual only 18 i.e.14% were aware about the aflatoxin and the remaining 108 i.e.86% were unaware about this. These unaware 86% individuals were made aware about aflatoxin during collecting information at the time of survey conducted.

Besides aflatoxin an effort was made to know if the consumer is aware about the toxin (other than aflatoxin) which may cause due to any other reason and the findings for this awareness is found that out of 126 individuals 40 (32%) have replied yes and remaining 86 (68%) individuals were found unaware, and these unaware individuals were made aware about other toxin during collecting information at the time of survey conducted.

CONCLUSION

So, to keep groundnut free from aflatoxin dry well, filled healthy pods and bring down pod moisture below 10%.Use always new and clean gunny bags or aluminium tin to store the groundnut. Produce must be stored in a well-ventilated leak proof room. Store bags on wooden pallet, keep one meter distance from walls and between stacks. Do not keep immature and damaged pods along with healthy pods. Do not dry diseased or pest infected pods along with healthy pods. During store the produce moisture should not exceed 10% .Try to avoid old and damaged bags for storing , which may be infested with pests. Try to avoid keeping bags directly on the floor. Remove shriveled, discolored and damaged kernels from the lot including the nuts with broken testa by hand picking and then put them in new gunny bags. By adopting and applying these tips, it has been possible to obtained aflatoxin risk free groundnut.

The occurrence of mycotoxins in agricultural commodities is a major health concern for livestock and humans. Aflatoxins are potent carcinogenic substance and have also been implicated in human diseases like hepatitis B, tuberculosis by suppressing immune system. Among all the parameter studied in the survey on aflatoxin awareness and assessment, from the data analyzed, it is concluded that the parameters like educational qualifications, occupation, family members and physical fitness are of least importance but the parameters which are related with direct consumption of oil for domestic purpose are of more importance. It is to be taken very seriously and there is an urgent need to aware the society people regarding adulteration in oil, insisted them to purchase good quality or branded company oil. It is necessary to consume oil in appropriate quantity, to much or over use i.e. beyond limit may cause health problems in future. All types of food materials stored for consumption must be well dried and stored properly.

Here in this aflatoxin survey studied it has been observed that only 14% individuals were aware and 86% were unaware about aflatoxin contamination in groundnut, so these 86% were made aware about aflatoxin and problems causing due to consumption of aflatoxin contaminated groundnut or oil. In our previous survey carried out for Muktainagar taluka it is found that the ratio of awareness to unawareness was obtained 36% and 64% respectively. In our next survey studied for Malkapur taluka of Buldana district it is found that the ratio of awareness to unawareness was obtained 60% and 40% respectively. If we have compared the awareness of the society people of these three district for aflatoxin it is found from the data that people of Pune taluka are at the least (14%) and Buldana taluka is at the top (60%) and taluka of Jalgaon district lies in between these two district (36%). So to make all such aflatoxin unaware individuals 100% aware about the contamination in the food items, there is a need to conduct campaign for this through college level by students of life sciences, Food Corporation of India, Food and Drugs Research Institute, Health and Agricultural departments. Food and Drugs Research Institute, Agricultural Processed Food Export and Development Agency (APEDA).Health and Agricultural departments should keep a check on this by sudden sample collecting, from market yards, provisions store and agricultural producers and consumers for and detecting the sudden level of aflatoxin contamination through ELISA and TLC method or any other reliable newly developed technology.

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