**RESEARCH ARTICLE**

# Incidence of mycotoxins in poultry feeds and feed ingredients used in Warangal (TS), India

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**ABSTRACT**

Incidence of mycotoxins is a major problem encountered by poultry industry as in most cases low grade feed ingredients are used in the formulation of feeds. Investigations carried out to assess the incidence of mycotoxins in poultry feeds revealed that aflatoxin followed by ochratoxin A were most common and contaminated large number of poultry feeds and feed ingredients. Most of the samples were found to be contaminated with more than one mycotoxin. Farm mixed feed samples were recorded with highest frequencies of mycotoxin contamination than the commercial brands,

**Keywords**: Poultry feeds, mycotoxins, aflatoxin, ochratoxin A, broilers, layers.

## INTRODUCTION

Contamination of food and agricultural commodities by various types of toxigenic molds is a serious nonetheless a widely neglected problem. Regardless of decades of extensive research, mold infestation still remains a challenging problem (Munkvold, 2003). It has been estimated by Food and Agriculture Organization (FAO) that worldwide, approximately 25% of the crops get contaminated by moulds and are affected by mycotoxins (Richard *et al.,* 1989; Rice and Ross, 1994), and the estimated loss extends to billions of dollars (Trail *et al.,* 1995). Poor harvesting practices, improper drying, handling, packaging, storage, and transport conditions contribute to fungal growth and increase the risk of mycotoxin production. Contamination of agricultural commodities by fungi results not only in the downgrading nutrient content but also cause a health hazard for human, livestock and poultry birds. The most notable importance of contamination of agricultural commodities by toxigenic fungi is buildup of mycotoxin concentrations to injurious levels in food and feeds (Perrone *et al.,* 2007). Poultry feed are formulated from a mixture of ingredients that include cereal grains, cereal byproducts, fats, plant protein sources, animal byproducts, vitamins, mineral supplements, crystalline amino acids and feed additives. The composition of the feed varies according to type of poultry bird (broiler or layer) and also age of the bird.

Since poultry feeds are rich in all types of nutrients easily to prone to microbial growth at appropriate conditions. Defects in formulations, faulty storage conditions and unseasonal rains promote the infestation by microorganisms. Of the potential contaminants, mycotoxigenic fungi are the most widespread and notorious particularly in hot, humid conditions. In view of the importance of mycotoxins in the health of poultry birds and a range of poultry feeds used, it was thought worthwhile to investigate the natural incidence of mycotoxins in different poultry feeds used in Warangal District, which is a major center for poultry industry in Telangana State.

## MATERIALS & METHODS

### Isolation and enumeration of mycotoxigenic fungi associated with poultry feed, feed ingredients

**Study region**

Samples of commercial poultry feeds, feed ingredients were collected from poultry farms located in Warangal district and the respective feed manufacturers located in other places also. In case of farm mixed poultry feeds, individual feed ingredients along with mixed feeds were also collected.

**Sampling criteria**

Samples of commercially prepared poultry feeds, farm mixed poultry feeds and feed Ingredients were collected through systematic random sampling from grain markets, feed ingredient suppliers, poultry farms and feed manufacturers. For each sample, three initial samples of three kg each were collected from different places. After thorough mixing, a composite sample of 1 kg placed in a sterile polythene bag was brought to the laboratory and they were refrigerated until further use. Conditions of the sample at the collection time were recorded.

**Natural incidence of mycotoxins in poultry feeds.**

Natural contamination of commercial poultry feeds was carried out by "rapid TLC method for multi-mycotoxin analysis" as suggested by Devegowda and Raju (2005).

Different mycotoxins produced by species of *Aspergillus, Fusarium and Penicillium* were detected by standard methods. Aflatoxins (Stack and Pohland, 1975); ochrotoxin-A (Gimeno, 1979); sterigmato-cystine (Adey and Mateles, 1964); penicillic acid (Gorst-Allman and Steyn, 1979); deoxynivalenol and nivalenol (Ramakrishna and Bhat, 1987); moniliformin, T-2 toxin and zearalenone (Kamimura *et al.*, 1981)

## RESULTS AND DISCUSSIONS

### 1. Broiler feeds

The mould infested broiler feed samples collected from different broiler poultry farms of Warangal district were analyzed for the presence of mycotoxins and the results are presented in Table 1. From table it is evident that the contamination of different broiler feeds with mycotoxins is a common feature. Out of 35 broiler concentrate feed samples tested for the presence of mycotoxins, 7 samples were positive for aflatoxins, 3 samples for ochratoxin A, 1 sample for zearlenone and 7 samples for T- 2 toxin. Sterigmatocystin was not found in broiler concentrate feed samples. Similarly, 28 samples of broiler concentrate feed with maize were positive for aflatoxins and 13 for ochratoxin A, 2 for zearalenone and 8 for T-2 toxin, out of 35 samples were screened. Sterigmatocystin was not detected in broiler concentrate feed with maize.

Out of 35 broiler pellet feed samples screened for presence of different mycotoxins, 9 samples were positive for aflatoxins, 2 for ochratoxin A and1 for T-2 toxin. Zearalenone and sterigmatocystin were not found in the broiler pellet feed samples tested. Similarly, out of 35 broiler pre starter crumbs samples screened for mycotoxin analysis, 3, 2, 1 and 1 samples were positive for aflatoxins, ochratoxin A, zearalenone and for sterigmatocystin respectively. However T-2 toxin was not detected in the samples screened. No toxin was reported in broiler starter feed samples.

### 2. Layer feeds

Different contaminated layer feed samples were collected from different layers poultry farms of Warangal district and screened for presence of different mycotoxins and the results are presented in Table 2. From the table it is evident thatout of the different layer feed samples screened for presence of mycotoxin contamination, homemade feed (mixed at the farm) samples were highly contaminated with

different mycotoxins. Screening of 35 mixed layer feed samples indicated that 25 samples were positive for

**Table 1 : Natural contamination of different broiler feeds with mycotoxins**

| Name of the broiler feed sample tested | Number of feed samples tested | Number of positive feed samples | % of incidence | Toxin detected |
|---|---|---|---|---|
| Broiler concentrate feed | 35 | 7 | 20.0 | Aflatoxins |
| | | 3 | 8.6 | Ochratoxin A |
| | | 1 | 2.9 | Zearalenone |
| | | 7 | 20.0 | T-2 toxin |
| | | ND | -- | Sterigmatocystin |
| Broiler concentrated feed with maize | 35 | 28 | 80.0 | Aflatoxins |
| | | 13 | 37.1 | Ochratoxin A |
| | | 2 | 5.7 | Zearalenone |
| | | 8 | 22.9 | T-2 toxin |
| | | ND | -- | Sterigmatocystin |
| Broiler pellet feed | 35 | 9 | 25.7 | Aflatoxins |
| | | 2 | 5.7 | Ochratoxin A |
| | | ND | -- | Zearalenone |
| | | 1 | 2.9 | T-2 toxin |
| | | ND | -- | Sterigmatocystin |
| Broiler pre starter crumbs | 35 | 3 | 8.6 | Aflatoxins |
| | | 2 | 5.7 | Ochratoxin A |
| | | 1 | 2.9 | Zearalenone |
| | | ND | -- | T-2 toxin |
| | | 1 | 2.9 | Sterigmatocystin |

ND = Not detected

**Table 2 : Natural contamination of different layer feeds with mycotoxins**

| Name of the layer feed sample tested | Number of feed smaples tested | Number of positive feed samples | % of incidence | Toxin detected |
|---|---|---|---|---|
| Home made feed (mixed feed) | 35 | 25 | 71.4 | Aflatoxins |
| | | 13 | 37.1 | Ochratoxin A |
| | | 2 | 5.7 | Zearalenone |
| | | 5 | 14.3 | T-2 toxin |
| | | 3 | 8.6 | Sterigmatocystin |
| Chick feed | 35 | 5 | 14.3 | Aflatoxins |
| | | 2 | 5.7 | Ochratoxin A |
| | | ND | -- | Zearalenone |
| | | 1 | 2.9 | T-2 toxin |
| | | ND | -- | Sterigmatocystin |
| Developer feed | 35 | 8 | 22.9 | Aflatoxins |
| | | 3 | 8.6 | Ochratoxin A |
| | | 1 | 2.9 | Zearalenone |
| | | 2 | 5.7 | T-2 toxin |
| | | ND | -- | Sterigmatocystin |
| Grower feed | 35 | 11 | 31.4 | Aflatoxins |
| | | 3 | 8.6 | Ochratoxin A |
| | | 1 | 2.9 | Zearalenone |
| | | -- | -- | T-2 toxin |
| | | 1 | 2.9 | Sterigmatocystin |
| Perlay feed | 35 | 9 | 25.7 | Aflatoxins |
| | | ND | -- | Ochratoxin A |
| | | ND | -- | Zearalenone |
| | | 3 | 8.6 | T-2 toxin |
| | | ND | -- | Sterigmatocystin |

**Table 3 : Natural contamination of different poultry feed ingredients with mycotoxins**

| Name of the feed ingredient tested | Nummber of samples tested | Number of positive samples | % of incidence | Toxin detected |
|---|---|---|---|---|
| Maize seed | 50 | 34 | 68.0 | Aflatoxins |
| | | 13 | 26.0 | Ochratoxin A |
| | | 2 | 4.0 | Zearalenone |
| | | 8 | 16.0 | T-2 toxin |
| | | 9 | 18.0 | Sterigmatocystin |
| Sunflower meal | 50 | 22 | 44.0 | Aflatoxins |
| | | 3 | 6.0 | Ochratoxin A |
| | | 1 | 2.0 | Zearalenone |
| | | 4 | 8.0 | T-2 toxin |
| | | ND | -- | Sterigmatocystin |
| Groundnut cake | 50 | 28 | 56.0 | Aflatoxins |
| | | 13 | 26.0 | Ochratoxin A |
| | | 3 | 6.0 | Zearalenone |
| | | 2 | 4.0 | T-2 toxin |
| | | ND | -- | Sterigmatocystin |
| Deoiled rice bran | 50 | 14 | 28.0 | Aflatoxins |
| | | 8 | 16.0 | Ochratoxin A |
| | | 6 | 12.0 | Zearalenone |
| | | 4 | 8.0 | T-2 toxin |
| | | 1 | 2.0 | Sterigmatocystin |
| Fish meal | 50 | 3 | 6.0 | Aflatoxins |
| | | ND | -- | Ochratoxin A |
| | | ND | -- | Zearalenone |
| | | ND | -- | T-2 toxin |
| | | 1 | 2.0 | Sterigmatocystin |
| Soybean meal | 50 | 9 | 18.0 | Aflatoxins |
| | | 6 | 12.0 | Ochratoxin A |
| | | 5 | 10.0 | Zearalenone |
| | | 4 | 8.0 | T-2 toxin |
| | | ND | -- | Sterigmatocystin |

aflatoxins and 13 samples for ochratoxin A, 2 for zearalenone, 5 for T-2 toxin and 3 for sterigmatocystin. This can be attributed for the usage of damaged feed ingredients by the layer farmers to reduce the feed cost.

When 35 chick feed samples were screened for their natural contamination of different mycotoxins 5, 2 and 1 sample were positive for aflatoxins, ochratoxin A and T-2 toxin respectively. Zearalenone and sterigmatocystin were not traced in the chick feed samples screened. Similarly, 35 developer feed samples screened for presence of mycotoxin, contamination 8 samples were positive for aflatoxins, 3 for ochratoxin A, 1 for zearalenone and 2 for T-2 toxin. Sterigmatocystin was absent in developer feed samples.

Screening of 35 grower feed samples revealed that 11 samples were positive for aflatoxins, similarly 3 for ochratoxin A, 1 for zearalenone and 1 for sterigmatocystin. T-2 toxin was not detected in grower feed samples screened. Out of of 35 prelay feed samples tested 9, 3 samples were positive for aflatoxins, T-2 toxin respectively. Interestingly, ochratoxin A, zearalenone and sterigmatocystin were not detected in the samples screened.

**3.Feed ingredients**

Feed ingredients are the key resources for contamination of feeds with mycotoxins. Hence, it was felt necessary to screen the different feed ingredients

used in Warangal district, and the results are shown in the Table 3. From the table it is evident that most of the feed ingredients screened were positive for different mycotoxins. Out of 50 samples of maize screened, 34 samples are positive for aflatoxins and 13 for ochratoxin A, 2 for zearalenone and 8 for T-2 toxin, and 9 for sterigmatocystin.

Out of 5 samples of sunflower meal screened for presence of mycotoxins, 22 samples were positive for aflatoxins, and 3 for ochratoxin A, 1 for zearalenone and 4 for T-2 toxin. No sample of sunflower meal was positive for sterigmatocystin. Similarly,out of 50 groundnut cake samples screened for presence of mycotoxins,28,13,3,2 samples were positive for aflatoxins, ochratoxin A, zearalenone, T-2 toxin respectively. Sterigmatocystin was not recorded in the samples screened.

Screening of 50 deoiled rice bran samples for their natural contamination of mycotoxins indicated that 14 samples were positive for aflatoxins and 8 for ochratoxin A, 6 for zearalenone, 4 for T-2 toxin and 1 for sterigmatocystin. Similarly, in 50 fish meal samples tested only 1 sample was positive for sterigmatocystin, 3 samples were positive for aflatoxins, ochratoxin A, zearalenone and T-2 toxins were not traced out in fishmeal sample. Similarly, when 50 soybean meal samples screened for presence of mycotoxins, 9 samples were positive for aflatoxins, and 6 for ochratoxin A, 5 for zearalenone and 4 for T-2 toxin. No sample was positive for sterigmatocystin contamination.

Studies on natural incidence of mycotoxins in poultry feeds revealed that aflatoxin followed by ochratoxin A are most common and contaminated large number of poultry feeds and feed ingredients. Most of the samples were contaminated with more than one mycotoxin. Farm mixed feed samples were recorded with highest frequencies of mycotoxin contamination than commercial brands. These findings are in line with the worldwide natural occurrence of different mycotoxins in poultry feeds and feed ingredients (Dalcero *et al.,* 2002; Labuda *et al.,* 2005; Oliveira *et al.,* 2006; Zinedine *et al.,* 2006; Rodrigues *et al.,* 2011; Rodrigues and Naehrer, 2012).Widespread occurrence of mycotoxins in all types of feeds and their significance in poultry industry calls for imposition of quality control regulations for commercial feeds or home-brew methods for detection of mycotoxins in the feeds prepared at farm level.

**Conflicts of interest:** The authors stated that no conflicts of interest.

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