



# AFLATOXIN LEVELS IN FEEDS AND FEED INGREDIENTS OF LIVESTOCK AND POULTRY IN KERALA

Received - 02.06.13  
Accepted - 01.10.13

## Abstract

Total aflatoxin and aflatoxin B<sub>1</sub> levels in feeds and feed ingredients of livestock and poultry in Kerala were analysed in 709 samples by fluorometry after extraction using specific monoclonal antibody based immune-affinity columns. The levels of total aflatoxin varied widely from 1 to 400 ppb in feeds and levels were found to be higher in poultry, duck and quail feeds when compared to their accepted dietary limits. Even though the levels of total aflatoxin varied from 1 to 680 ppb among different feed ingredients, the mean levels were found to be very high in maize ( $122 \pm 53.36$  ppb) and ground nut cake ( $139.75 \pm 31.1$  ppb). Aflatoxin B<sub>1</sub> contributed to 66 to 82% of total aflatoxins in the feed. Total aflatoxin levels were found to be very high during the months of October and November (North-east monsoon season).

**Keywords:-** Aflatoxin, aflatoxin B<sub>1</sub>, livestock feed, feed ingredients

Aflatoxins are a closely related heterocyclic group of toxic secondary metabolites of certain strains of fungi, chiefly *Aspergillus flavus* and *A. parasiticus*. Since warm and humid climatic conditions favour aflatoxin production, contamination of feed grains and oil cakes with aflatoxin are more common in tropical countries. Aflatoxins produce most severe and chronic problems in agriculture, livestock, poultry and human beings. They are associated with low productivity, immunosuppression, liver and renal damages, carcinogenic and teratogenic effects. Derivatives of aflatoxins are found in milk, egg, meat and their products which point to its public health importance. This study was undertaken to estimate

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the level of aflatoxin contamination in livestock and poultry feeds and feed ingredients in Kerala during various seasons.

## Materials and Methods

A total of 709 samples of feed and feed ingredients were collected from different livestock and poultry farms of Kerala. Aflatoxins were extracted by blending 50 g of feed sample with salt and 100 ml solution of methanol and distilled water (80:20). The filtered extract is diluted (1:4) using distilled water and filtered again through glass fibre filter paper. From 10 ml of the filtrate, aflatoxins were adsorbed onto a monoclonal antibody based immunoaffinity column by passing it through the column at the rate of two drops/sec. Aflatoxins were eluted out into a cuvette using one millilitre of HPLC grade methanol. This elute was derivatized with one millilitre of developer solution and the levels of aflatoxins were estimated quantitatively using a calibrated fluorometer (Cigic and Prosen, 2009). Levels of aflatoxin B<sub>1</sub> was also estimated in 17 samples collected at random by the same procedure using immunospecific columns for Aflatoxin B<sub>1</sub>. The mean levels of total aflatoxin, aflatoxin B<sub>1</sub> and proportion of aflatoxin B<sub>1</sub> in different feeds and feed ingredients were also analysed. Seasonal variations influencing level of total aflatoxin in feeds were also analysed.

## Results and Discussion

The levels of aflatoxin in different feeds and feed ingredients are summarised in Table 1 and 2. The levels of aflatoxin varied widely in all types of feeds from 1 to 400 ppb. The mean level of aflatoxin was found to be higher in poultry, duck and quail feeds

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compared to their acceptable dietary limits as per the recommendations of package of practices. Acceptable limit of aflatoxin in feed of poultry is 20 ppb and that of duck is 10 ppb. The levels of aflatoxin varied widely in all types of feed ingredients from 1 to 680 ppb. The mean level of aflatoxin was found to be very high in maize ( $122 \pm 53.36$  ppb) and ground nut cake ( $139.75 \pm 31.1$  ppb). However, these levels are lower than the levels of total aflatoxin recorded in poultry feeds and feed ingredients by Khan (1994).

The levels total aflatoxin and aflatoxin B<sub>1</sub> in different feeds are summarised in Table 3. Aflatoxin B<sub>1</sub> contributed 66 to 82 per cent of total aflatoxins present in the feed.

Levels of total aflatoxin in feeds and feed ingredients during different season of the year were analysed and the results are summarised in Table.4. Among the 709 samples tested during the different season of the year, total aflatoxin levels were found to be very high during the north-east monsoon season (October and November). Storage of cereals in warm and humid conditions increases the aflatoxin contamination (Saleemullah *et al.*, 2006). Giridhar and Krishnamurthy (1977) found that 25.7 per cent of commercial ground nut oil contained more than 100 ppb aflatoxin and higher toxin concentration was found in oil extracted from kharif (rainy) season crop.

It is practically difficult to produce feeds and feed ingredients free from aflatoxin. But the very high levels of aflatoxin in maize and ground nut cake warrants to limit their use in feed to minimum required levels and only after proper testing for its levels. Reddy *et al.*,

(2009) reported that only two per cent of the rice samples collected from different states of India showed aflatoxin B<sub>1</sub> contamination above the permissible limits. Jowar and broken rice could be used to replace maize as energy supplements in feed, since these ingredients were found to contain only permissible levels of toxin. Aflatoxin B<sub>1</sub> contributes to the major portion of total aflatoxin in feed. Bhat *et al.*, (1996 and 1997) showed that aflatoxin B<sub>1</sub> levels exceeded the permissible Indian regulatory limit of 30 ppb in 21 per cent of ground nut samples and 26 per cent of maize samples collected from 11 different states. Since aflatoxin B<sub>1</sub> is the most toxic aflatoxin, its level has to be considered along with total aflatoxin before accepting or choosing a feed or feed ingredient for dietary use in animals.

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**Table 1.** Levels of aflatoxin in different feeds

Sl. No.	Type of feed	No. of samples tested	Level of aflatoxin (ppb)	
			Range	Mean $\pm$ SE
1	Cattle feed	10	2 – 100	26.90 $\pm$ 9.2
2	Pig feed	33	3 – 100	23.27 $\pm$ 4.2
3	Rabbit feed	53	1 – 88	22.74 $\pm$ 2.9
4	Poultry feed	335	1 – 400	33.26 $\pm$ 2.8
5	Duck feed	102	1 – 120	20.71 $\pm$ 2.0
6	Quail feed	61	2 – 350	53.70 $\pm$ 9.0
7	Turkey feed	49	3 – 70	17.76 $\pm$ 1.95

**Table 2.** Levels of aflatoxin in different feed ingredients

Sl. No.	Feed ingredient	No. of samples tested	Level of aflatoxin (ppb)	
			Range	Mean $\pm$ SE
1	Maize	17	1 – 680	122 $\pm$ 53.36
2	Jowar	13	1 – 12	5.15 $\pm$ 1.0
3	Broken rice	10	3 – 25	12.60 $\pm$ 2.4
4	Ground nut cake	12	3 – 380	139.75 $\pm$ 31.1
5	Dried fish	7	5 – 30	15.57 $\pm$ 3.3
6	Rice bran	7	2 – 36	10.86 $\pm$ 4.4

**Table 3.** Levels of total aflatoxin and aflatoxin B1 in different feeds

Sl. No.	Type of feed	Mean level of aflatoxin		Aflatoxin B1 (%)
		Total aflatoxin (ppb)	Aflatoxin B1 (ppb)	
1	Poultry feed	42.00	20.00	66.19
2	Duck feed	37.71	25.14	66.31
3	Quail feed	22.00	18	81.82
4	Turkey feed	32.00	26.33	81.26

**Table 4.** Levels of total aflatoxin in feeds during different season

Sl. No.	Season	No. of samples tested	Total aflatoxin levels (ppb)
1	Winter (December, January and February)	185	25.08 $\pm$ 32.57
2	Summer (March, April and May)	157	21.09 $\pm$ 27.27
3	South-West Monsoon (June, July, August and September)	200	24.68 $\pm$ 30.05
4	North-East Monsoon (October and November)	167	65.19 $\pm$ 104.81

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