The incidence of mycotoxins in litter, feed, and livers of chickens in Natal

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Received 17 April 1985

Mycotoxins, and more specifically aflatoxins, have been found in samples of feed, litter, and liver tissue obtained from broiler chicken houses that had a high incidence of ascites and were also associated with low growth rates. It is suggested that aflatoxin may act synergistically with other stress factors to promote the ascites condition.

Mikotoksiene en meer spesifiek aflatoksiene is gevind in monsters van voer, mis en lewerweefsel wat verkry is van braaikuikenhokke wat 'n hoë voorkoms van waterpens het. Dit is ook geassosieer met lae groeitempo's. Daar word voorgestel dat aflatoksien sinergisties mag optree saam met ander stresfaktore om die voorkoms van waterpens te bevorder.

Keywords: Aflatoxin, ascites, broiler chickens, synergism, South Africa

The presence of mycotoxins in poultry feed can affect the health of the birds seriously (Smith, 1982). Mycotoxins are highly poisonous secondary metabolites produced by several genera of fungi. They have been found in many animal feeds and have been shown to adversely affect animals ingesting them (Mirocha & Christensen, 1974). More than 200 mycotoxins are now known (Cole, & Cox, 1981) and each one will be more or less toxic depending on animal species. Aflatoxin B_1 has been shown, in laboratory trials, to be one of the most toxic and to cause a number of disease conditions in poultry, including impairment of kidney function (Tung, Wyatt, Thaxton & Hamilton, 1973), decreased mass gain, impaired immune response, hepatic necrosis, and haemorrhage (Pier, Richard & Cyszewski, 1980). Therefore, the occurrence of mycotoxins and toxigenic strains of fungi in agricultural products was investigated during 1982/83.

Samples of chicken litter, feed, and liver tissue were obtained from broiler houses in the Durban – Pietermaritzburg area of Natal, containing both healthy and diseased birds. These were taken on an *ad hoc* basis and were dependent on the location and frequency of disease symptoms. Random samples were taken where possible. The mycotoxins were analysed using a modification of the method of Patterson & Roberts (1979) and have been described previously (Dutton & Westlake, 1985).

A total of 142 poultry feed samples were analysed over a 2-year period and these revealed that samples from broiler houses where poor growth and ascites had been reported, had consistently more aflatoxin in their diets than was found in control samples (Table 1). Control feeds were random samples

Table 1 Incidence of mycotoxins in chicken feed, litter, and liver in cases of broiler disease

Sample type and disease condition	Aflatoxin B_1			Other mycotoxins[b]		
	Total no. of samples examined	Incidence (range)[a]	% positive	Incidence	% positive	Total positive (%)
Feed						
Control	25	3(T-20)	12	1	4	16
Poor growth[c]	75	18(T-80)	24	5	7	31
Ascites	30	9(T-100)	30	2	7	37
Other[d]	12	1(20)	8	ND	–	8
Litter						
Control	72	10(0 – 40)	14	ND	–	14
Poor growth[c]	63	11(T-1000)	17	3	5	22
Ascites	27	6(T-20)	22	ND	–	22
Other[d]	4	1(T)	25	ND	–	25
Liver						
Healthy	4	ND	–	ND	–	–
Poor growth[c]	9	ND	–	ND	–	–
Ascites	27	5(T-40)	19	ND	–	19
Other[d]	14	ND	–	ND	–	–

[a]Concentration (μg/kg) given in parenthesis where T = trace and ND = not detected.
[b]Comprises patulin and trichothecenes.
[c]Covers general malaise and nondescript diseases.
[d]Covers malabsorption and gizzard erosion.

obtained mainly from feed millers and hence represent the general occurrence of aflatoxin in feed samples. Furthermore, the highest level of aflatoxin B_1 found in feeds from houses with cases of ascites was 100 μg/kg in control samples. From Table 1 it can also be seen that mycotoxins other than aflatoxins were also found in feed samples and that the percentage occurrence was again associated with disease conditions.

The occurrence of mycotoxins in litter followed a similar trend to that found in feed samples (Table 1). Under normal circumstances one would not expect the presence of toxins in litter to affect the health of the chickens significantly. However, in one series of litter samples analysed, consisting only of groundnut hulls, aflatoxin B_1 was found to be present at levels in excess of 10 μg/g and was associated with a very poor growth rate of broiler chickens.

Examination of liver tissue showed the presence of aflatoxin B_1 in five out of 27 birds suffering from ascites (Table 1). This is the first time that aflatoxin has been found in such samples in this laboratory. It is possible that the timing of sampling is a critical factor, as aflatoxin B_1 is rapidly metabolized and excreted by animal tissues (Pier, Heddlestone, Cyszewski & Patterson, 1973; Harland & Cardeihac, 1975). This would result in depletion of toxin levels below detection limits within a short time after ingestion.

The incidence of fungi in the various materials examined is shown in Table 2. Those capable of mycotoxin production include members of the genera *Aspergillus, Penicillium,* and

Table 2 Incidence of toxin-producing fungi found in chicken feed and litter in 1982/83 for the Durban – Pietermaritzburg area of Natal

Sample type and disease condition	Total no. of samples	Number of samples with viable fungal propagules (% total)				
		Aspergillus spp.	*Aspergillus flavus*	*Fusarium* spp.	*Penicillium* spp.	Other[a]
Feed						
Control	25	10(40)	10(40)	5(20)	2(8)	8(32)
Poor growth[b]	75	3(4)	14(19)	15(20)	5(7)	19(25)
Ascites	30	1(3)	3(10)	9(30)	1(3)	3(10)
Other[c]	12	1(8)	3(25)	4(33)	2(17)	4(33)
Litter						
Control	72	29(40)	11(14)	8(11)	ND	71(99)
Poor growth[b]	63	7(11)	8(13)	3(5)	ND	9(14)
Ascites	27	ND	3(11)	1(4)	ND	ND
Other[c]	4	2(50)	2(50)	1(25)	ND	3(75)

[a]Other covers non-toxin producers and unidentified fungi; some samples contained more than one genera. Figure in parenthesis is percentage of total samples examined.
[b]Covers general malaise and nondescript disease.
[c]Covers malabsorption syndrome and gizzard erosion and two cases of aspergillosis.

Fusarium whilst fungi listed as other include species from the genera *Mucor, Trichoderma, Rhizopus* and in the case of litter, a large number of yeasts.

The results show widespread contamination of feed and litter with various fungal genera but with the highest incidence being found in control samples, perhaps owing to a lack of competition from other micro-organisms.

It was shown by Chang & Hamilton (1981) that aflatoxin increases the susceptibility of broilers to infectious bursal disease (IBD) and at the same time alters the symptoms of typical IBD. It was further shown that aflatoxin can exert a synergistic effect with other conditions such as excess heat, thereby increasing the severity of disease (Wyatt, Thaxton & Hamilton, 1975). It is therefore difficult to determine the possible influence of aflatoxin in a disease such as ascites but aflatoxin is likely to act synergistically with other stress factors to cause this condition.

In conclusion, this survey indicates that mycotoxins, especially aflatoxins, may depress production and could play a significant role in certain poultry diseases in South Africa.

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