

EFFECT OF AFLATOXIN AND CYCLOPIAZONIC ACID IN FEED ON THE PERFORMANCE OF BROILER CHICKEN

R. Kumar¹ and C. Balachandran²

Department of Veterinary Pathology,
Veterinary College and Research Institute, Namakkal-637001, Tamil Nadu.

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Mycotoxins occur in feed and feedstuffs independently or in combination. Co-occurrence of the aflatoxin (AF) with cyclopiazonic acid (CPA), an emerging important mycotoxin, has been reported in various feed and feedstuffs. Besides, certain strains of *Aspergillus flavus* produce both AF and CPA (Gallagher *et al.*, 1978). Thus, AF-CPA combination constitutes a potential threat to poultry health. Limited literature on the subject prompted us to take up this study.

Materials and Methods

Aflatoxin and CPA were produced on rice culture by growing *Aspergillus parasiticus* NRRL 2999 and *Penicillium griseofulvum* NRRL3523, respectively (Shotwell *et al.*, 1966; Rathinavelu and Shanmugasundaram, 1984). Aflatoxin was estimated by Romer method (1975) and CPA by colorimetric method (Rathinavelu and Shanmugasundaram, *loc. cit.*) Known amounts of powdered rice cultures containing AF and CPA were incorporated by directly mixing into AF and CPA free broiler starter mash to yield 1 ppm AF and 20 ppm CPA. A control diet tested and found free of AF and CPA was also prepared. The

diets contained 23 per cent crude protein. Forty, day-old commercial broiler chicken (Vencob, India) were weighed, wing banded and randomly allotted to four treatment groups. Birds were raised on battery brooders with *ad libitum* supply of feed and water. The diets were fed for 28 days. A second trial was conducted with another 40 birds. Body weight and feed consumption were recorded at weekly intervals. Data were statistically analyzed as per Snedecor and Cochran (1989).

Results and Discussion

Mean weekly body weights and total feed consumed by broiler chicken fed AF and CPA singly and in combination are presented in Tables 1 and 2. Mean body weight gains observed at the end of the experimental period were 548.95, 350.75, 528.9 and 307.75 g for the control, AF, CPA and AF-CPA groups respectively. Highly significant ($P < 0.01$) differences in body weights were observed among the treatment groups. The AF and AF-CPA treated groups did not differ significantly except in the third week. Significant ($P < 0.05$) reduction in the weight gain was observed in AF and AF-CPA groups.

*Part of the M.V.Sc. thesis of the first author approved by the Tamilnadu Veterinary and Animal Sciences University, Chennai-600 051. ¹Assistant Professor, Department Veterinary Pathology, R.G. College of Veterinary & Animal Sciences, Pondicherry, ²Centralised Clinical Laboratory, Madras Veterinary College, Chennai - 600 007.

Reduced weight gain induced by AF was attributed to reduced feed consumption as observed in this study and inhibition of protein synthesis (Krogh, 1987). Significant reduction in weight gain has also been reported in broiler chickens fed 1 ppm AF for 4 weeks (Balachandran and Ramakrishnan, 1987). The body weights of CPA treated birds did not differ significantly from that of the control. However, significant reduction in the weight gain was reported in experimental CPA toxicosis of broiler chickens but at a higher level i.e. 25 ppm (Balachandran and Parthasarathy, 1996). 45 ppm (Dwyer *et al.*, 1997) and 34 ppm (Gentles *et al.*, 1999) levels.

Significant reduction in body weight gain was observed in broiler chickens fed AF-CPA diet. Significant reduction in body weight gain of broiler chickens was reported by Smith *et al.* (1992) but at a higher dose level, AF (3.5 ppm) and CPA (50 ppm). Though, the reduction in body weight gain observed in AF-CPA treated group seems

to reflect the toxicity of AF, the reduction in weight gain was significant when compared to the AF group in the third week and a seven per cent more reduction was observed in AF-CPA treated group at the end of the experimental period indicating an additive toxic effect.

Significant ($P < 0.05$) differences in feed consumption were observed among the treatment groups. Feed consumption of CPA treated birds was not altered significantly. But significant reduction in feed consumption was reported in broiler chickens fed 25 and 50 ppm for 28 days (Balachandran and Parthasarathy, *loc. cit.*) and 45 ppm for 21 days (Dwyer *et al.*, *loc. cit.*). Probably doses higher than 20 ppm is required for a similar effect. Though the difference in feed consumption between AF and AF-CPA fed groups was not significant, the AF-CPA fed groups consumed about 10 per cent less than the AF fed group indicating combined effect of the toxin. The differences in feed conversion between

Table 1 - Weekly body weights (g) of broiler chickens fed aflatoxin and cyclopiazonic acid alone and in combination (Mean \pm S.E.)

AF (ppm)	CPA (ppm)	Day old (n=20)	Weeks							
			1 (n=20)	RB W	2 (n=20)	RB W	3 (N=20)	RB W	4 (N=20)	RBW
0	0	41.30 \pm 0.57	101.00 \pm 3.03 ^a	100	214.50 \pm 8.13 ^a	100	369.50 \pm 11.35 ^a	100	590.25 \pm 15.60 ^a	100
1	0	41.50 \pm 0.57	86.25 \pm 3.24 ^b	85	160.75 \pm 6.60 ^b	75	268.65 \pm 10.32 ^b	73	392.25 \pm 22.16 ^b	66
0	20	41.60 \pm 0.93	98.75 \pm 2.69 ^a	98	198.00 \pm 7.10 ^a	92	351.50 \pm 13.48 ^a	95	570.50 \pm 18.65 ^a	97
1	20	41.00 \pm 1.64	88.00 \pm 3.49 ^b	87	149.50 \pm 8.28 ^b	69	231.25 \pm 12.05 ^c	63	348.75 \pm 18.74 ^b	59

Means with same superscript in the same column do not differ from each other ($P > 0.05$) RBW - Relative Body Weight

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Table 2 - Mean weekly feed consumption (g) of broiler chickens fed aflatoxin (AF) and cyclopiazonic acid (CPA) alone and in combination (Mean±S.E.)

AF (ppm)	CPA (ppm)	Weeks				Treatment Total
		1	2	3	4	
0	0	68.23	196.40	323.73	486.73	1075.09 ^a
1	0	67.91	133.67	230.14	366.06	797.78 ^b
0	20	72.75	190.79	306.00	489.17	1058.71 ^a
1	20	66.87	113.42	196.18	343.33	719.80 ^b

Means with same superscript do not differ from each other ($P>0.05$).

treatment groups were not significant. The feed conversion was not altered in CPA treated groups as was also observed by earlier workers (Balachandran and Parthasarathy, *loc. cit.*) similarly, the feed conversion in AF-CPA fed group was not altered significantly as was also reported by Smith *et al.* (*loc. cit.*). Data from this study demonstrate that AF and CPA consumption can limit broiler performance and health.

Summary

Feeding 1 ppm of aflatoxin (AF) and 20 ppm of cyclopiazonic acid (CPA) for four weeks from the day of hatch to broiler chicken significantly ($P<0.05$) affected gain and feed consumption in AF-CPA groups but not in the CPA fed group. A seven per cent more reduction in weight was observed in AF-CPA treated group at the end of the experimental period. The data from this study indicated that AF-CPA combination could limit broiler performance.

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