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EFFECT OF OCHRATOXIN A AND CITRININ TOXINS ON CERTAIN MINERAL AND ELECTROLYTES LEVELS IN BROILER CHICKEN

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ABSTRACT
The present investigation deals with effect of ochratoxin A (OA), citrinin (CTN) and their combination on certain biochemical parameters in broiler chicken at weekly intervals. The broiler chickens were divided into four groups of 50 chicks each and fed with OA 1ppm, CTN 12.5 ppm and combination of OA+CTN (1 ppm OA + 12.5 ppm CTN) in feed up to 35 days of the experiment. The blood samples were collected from all the groups at weekly interval to study the effect of this toxin on various biochemical parameters. Biochemically, hypocalcaemia, hypophosphoremia, hyponatraemia and hypokalaemia were observed. Biochemical alterations were maximum in the combination group than the individual toxin treated group. The interaction of both the toxins was found to be additive.

KEYWORDS: biochemical alterations, ochratoxin A, citrinin, hypocalcaemia, hypophosphoremia, hyponatraemia and hypokalaemia broiler chicken.

INTRODUCTION

Mycotoxins comprise a structurally diverse family of naturally occurring fungal toxins which directly or indirectly contaminate the feed of livestock and poultry resulting in toxicities. In poultry, mycotoxicosis causes reduced growth rate, lowered feed conversion, impaired resistance to infectious disease and reduced vaccination efficacy with lesions in many organs (Coulombe, 1993). Ochratoxin and citrinin may occur as co-contaminants of feed and feed ingredients. Considering the effects of these mycotoxins on health and performance of birds as well as huge economic losses involved the present work was taken up to study in detail the effect of individual and combined toxicosis of ochratoxin and citrinin in broilers. The present investigation was undertaken to asses the alterations in the calcium, phosphorous, sodium and potassium levels in broiler chicken fed a diet containing, commonly occurring levels of OA and CTN, either alone or in combination.

MATERIAL AND METHODS

Pure cultures of *Aspergillus ochraceus* (NRRL-3174) and *Penicillium citrinum* (NRRL 1841), maintained at Department of Poultry Science and Animal Nutrition, Veterinary College, KVAFSU, Hebbal, Bangalore were used for OA and CTN production. The concentrations and purity of OA and CTN were estimated using thin layer chromatography at the Animal Feed Analytical and Quality Control Laboratory, Veterinary College and Research Institute, Nammakal – 637 001. Unsexed, day old Vencobb broiler chicks (200 numbers) were obtained from M/S Akash Hatcheries, Bangalore. They were provided with optimum conditions of brooding and management. Poultry mash, both starter and finisher without addition of toxin binder. They were tested for the

Presence of mycotoxins such as Aflatoxin, ochratoxin and citrinin. After ascertaining the mycotoxin free status of the feed, they were kept in individual labeled bins for further use. On day one of age, the broiler chicks were randomly divided into four different dietary treatment groups of 50 birds each *viz.,* Group I, fed standard mytoxin free basal diet (control), Group II, diet containing 1 ppm OA, Group III, diet containing 12.5 ppm CTN, Group IV, diet containing 1 ppm OA + 12.5 ppm CTN. Six birds from each group were sacrificed on day 7th, 14th, 21st, 28th and 35th day of the experiment. During each sacrifice, 5ml blood samples were also collected in non- heparinised vials. The serum was separated after eight hours and stored at -20^{o}C until further analysis. The sera were harvested and analysed for biochemical parameters such as Calcium, Phosphorus, Calcium/phosphorus ratio, Sodium and Potassium. Total serum calcium were estimated by O-Cresophthalein complexone method, phosphorus by modified Metol method, sodium and potassium by colorimetric method. The data generated from different parameters of experimental study were subjected to statistical analysis one-way analysis of variance (ANOVA) test using Graph Pad Prism software as per Snedecor and Cochran (1989).

RESULTS AND DISCUSSION

The values of various biochemical parameters are presented in Table 1. The overall mean values for calcium were significantly decreased in all the mycotoxin fed groups when compared to the control. Similar observation was also made in broiler chicks[1] fed with citrinin. Among the mycotoxin fed groups no significant difference was observed between Group III and IV. The decreased calcium level could be attributed to reduced feed intake and poor intestinal absorption in the mycotoxin fed birds. Significant differences were noticed between Group III, IV and control birds. Similar observation was also made in broiler chicks[3] fed with citrinin. However, a numerical decrease in phosphorus level was noticed in Group II when compared to the control. The decreased phosphorus level could be attributed to reduced feed intake, excess renal excretion and poor intestinal absorption in the

mycotoxin treated groups. There was a significant decrease in the sodium levels of birds fed with mycotoxin when compared to the Group I. Similar observation were also made in broiler chicks[1,2,3] fed with citrinin. The Group III and IV did not show significant difference between them. The overall mean value of sodium in Group II was significantly lower than the Group I. Low dose of CTN employed in this study coupled with decrease sodium absorption due to reduced feed intake might be the reason for decreased in sodium level. There was a significant decrease in the potassium level in the mycotoxin fed groups when compared to the control. Similar observations were also made in broiler chicks[2] fed with citrinin. Between the mycotoxin fed groups, there was no difference in the mean potassium value. Whereas there was a significant difference between Group III and IV. The hypokalaemia observed in the present study could be attributed to decreased feed intake, malabsorption and excess loss of potassium in urine due to nephritis. The comparative evaluation of the above biochemical observations of OA and CTN in the present study indicated that the simultaneous exposure of OA and CTN was found to be additive in broiler chicken. The commonly occurring dietary mycotoxin exposure to different animal species and birds suggests the need for evaluation of these toxin for their synergistic effect when they occur in combination.

TABLE 1: Effect of OA, CTN and their combination on biochemical parameters in broiler chicken (Mean ± SE)

Parameter/Intervals	Group I (control)	Group II (OA)	Group III (CTN)	Group IV (OA+CTN)
Serum calcium (mg/dL)				
7 day	9.57 ± 0.24	7.89 ± 0.06	7.24 ± 0.08	6.86 ± 0.17
14 day	9.96 ± 0.27	8.02 ± 0.09	7.84 ± 0.06	6.99 ± 0.14
21 day	10.26 ± 0.22	8.10 ± 0.05	8.08 ± 0.05	7.71 ± 0.18
28 day	10.73 ± 0.19	9.75 ± 0.19	8.18 ± 0.08	8.00 ± 0.08
35 day	11.02 ± 0.18	10.76 ± 0.17	8.36 ± 0.17	8.16 ± 0.09
Mean value	10.31^{a} ± 0.65	8.90^{b} ± 0.71	7.94^{cd} ± 0.72	7.54^{d} ± 0.73
Phosphorus (mg/dL)				
7 day	7.18 ± 0.07	7.10 ± 0.06	6.18 ± 0.17	6.16 ± 0.16
14 day	7.15 ± 0.06	7.08 ± 0.04	6.29 ± 0.20	6.16 ± 0.16
21 day	7.09 ± 0.04	7.02 ± 0.03	6.32 ± 0.19	6.07 ± 0.12
28 day	6.55 ± 0.15	6.34 ± 0.18	6.27 ± 0.19	5.78 ± 0.18
35 day	6.36 ± 0.18	6.00 ± 0.14	5.49 ± 0.18	5.38 ± 0.14
Mean value	6.87^{a} ± 0.75	6.71^{a} ± 0.76	6.11^{b} ± 0.78	5.91^{b} ± 0.78
Calcium/phosphorus ratio				
7 day	1.80 ± 0.04	1.64 ± 0.02	1.39 ± 0.03	1.14 ± 0.02
14 day	1.76 ± 0.03	1.67 ± 0.02	1.41 ± 0.01	1.16 ± 0.01
21 day	1.73 ± 0.02	1.69 ± 0.02	1.46 ± 0.02	1.18 ± 0.02
28 day	1.74 ± 0.01	1.72 ± 0.01	1.52 ± 0.03	1.32 ± 0.04
35 day	1.76 ± 0.03	1.71 ± 0.01	1.59 ± 0.09	1.49 ± 0.02
Mean value	1.76^{a} ± 0.91	1.69^{b} ± 0.91	1.47^{c} ± 0.92	1.26^{d} ± 0.93
Sodium (mEq/L)				
7 day	148.00 ± 2.58	132.78 ± 2.72	127.06 ± 4.72	121.85 ± 3.77
14 day	147.42 ± 2.39	133.61 ± 2.66	125.67 ± 3.89	122.96 ± 3.42
21 day	146.16 ± 1.95	134.30 ± 2.55	124.70 ± 3.32	123.25 ± 2.51
28 day	143.85 ± 1.90	138.16 ± 2.67	123.92 ± 3.72	123.76 ± 3.61
35 day	142.25 ± 2.45	140.18 ± 3.36	124.98 ± 3.18	123.52 ± 3.46
Mean value	145.54^{a} ± 3.86	135.81^{b} ± 3.63	125.27^{cd} ± 3.44	123.07^{d} ± 3.30
Potassium (mEq/L)				
7 day	3.72 ± 0.05	3.43 ± 0.11	3.42 ± 0.11	3.15 ± 0.06
14 day	3.71 ± 0.05	3.46 ± 0.10	3.42 ± 0.11	3.14 ± 0.05
21 day	3.60 ± 0.08	3.47 ± 0.08	3.43 ± 0.04	3.16 ± 0.07
28 day	3.98 ± 0.05	3.74 ± 0.08	3.53 ± 0.12	3.25 ± 0.17
35 day	4.41 ± 0.26	3.59 ± 0.05	3.38 ± 0.06	3.10 ± 0.04
Mean value	3.88^{a} ± 0.85	3.54^{b} ± 0.85	3.44^{b} ± 0.86	3.16^{c} ± 0.87

Mean values bearing at least one common superscripts in a row indicates no significant difference (P≥0.05) with each other.

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