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Effect of Dietry Lead Exposure on Performance and Their Alleviation by Antioxidants in Broilers

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ABSTRACT

A total no. of 126 day old broiler chicks (Ven-Cobb strain) were randomly assigned into 6 treatments groups A, B, C, D, E and F. The birds of group A were kept as healthy control, while group B received lead acetate @ 200 mg/kg alone, where as, birds of group C, D, E and F received Lead acetate @ 200 mg/kg + Ascorbic acid @ 200 mg/kg, lead acetate @ 200 mg/kg along with α-tocopherol @ 100 mg/kg + Selenium @ 0.1 mg/kg, Lead acetate @ 200 mg/kg + DL-methionine @ 100 mg/ kg and Lead acetate @ 200 mg/kg + methanolic extract of Cissus quadrangularis (CQE) @ 400 mg/kg respectively. Lead caused body weight to decrease significantly. Lead (200 mg/kg basal diet) had an inhibitory effect on the growth of broilers. The addition of ascorbic acid, α-tocopherol & Se and DL-methionine to the diet tended to reverse the depressive effect of lead on growth with maximum efficacy showed by DL-methionine followed by Vit-E & Se. However, the negative growth effect of lead was not fully overcome by the addition of methanolic extract of Cissus quadrangularis (CQE) at a dose of 400 mg/kg feed.

Key words: *Lead, toxicity, antioxidants, growth performance, broilers.*

INTRODUCTION

Lead a potent heavy environmental pollutant is naturally occurring elements that has been mobilized and redistributed to a large extent in the environment by industrialization and urbanization process[1]. stated that lead contamination of environment due its prolonged exposure and slow rate of elimination[2-3], lead has reached to such a harmful level that it can affects the growth, productivity and health of poultry as well as animals. But poultry has not been studied to the desired extent in comparison with other farm animals. With a view to study the toxic effect of lead on growth performance of broilers, present investigation was under taken. We also aimed to determine whether the negative effects of lead, attributed to reduced growth, could be reversed by adding antioxidants.

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MATERIALS AND METHODS

In this study hundred twenty six day old broiler chicks (Ven-Cobb strain) were randomly divided into six treatment groups (n=21) as A, B, C, D, E and F and all treatments were given to chicks on the basis of per kg basal diet daily for the period of 42 days. The birds of group-A were kept as healthy control received only basal diet, birds of group- B received lead acetate alone @ 200 mg/kg where as birds of group-C received lead acetate @ 200 mg/kg along with ascorbic acid @ 200 mg/kg, group-D got Vit-E @ 100 mg/kg and Se @ 0.1 mg/kg, group-E received DL-methionine @ 100 mg/ kg and methanolic extract *Cissus quadrangularis* (CQE) @ 400 mg/kgwas given to group-F respectively for 42 days. The effect of lead toxicity on growth performance in broilers was evaluated on the basis of average weekly feed consumption, body weight and feed conversion ratio. For average weekly body weights, initial body weight of individual chick on first day of experiment was recorded. Subsequently body weights were recorded at weekly interval up to six weeks for each group.

Statistical Analysis

The data were analyzed statistically using analysis of variance with one way classification followed by Dancan's Multiple Range Test (DMRT) to find out the significance of difference between mean values of different groups as per the procedure outlined by Snedecor and Cochran[4].

RESULTS AND DISCUSSION

The effects of lead, Vit-C, Vit-E & Se, DL-methionine and CQE on average body weight (ABW), average feed consumption (AFC) and feed conversion ratio (FCR) are presented in the Table-1 up to 42 days.

At the end of the study values of AFC were 2331.23 ± 34.27, 2353.80 ± 46.66, 2354.47 ± 17.43, 2399.52 ± 30.07, 2507.09 ± 10.07 and 2330.86 ± 29.25 gram for group A, B, C, D, E and F respectively (Table-1) indicating non significant ($P>0.05$) difference in AFC in all groups except in group E which had significantly higher ($P<0.05$) AFC than the all other groups. Perusal of data pertaining to average body weight in grams on day 42 revealed significantly ($P<0.05$) reduced ABW (Table-1) in group B (1602.49±10.77) as compare to group A (1687.14±18.58), group C (1779.93±26.74), group D (1798.57±9.09), and group E (1859.37±3.93) but was nonsignificant ($P>0.05$) in group F (1602.05±7.18). The feed conversion ratio of group B (1.47±0.0203) was significantly ($P<0.05$) higher (Table-1) from group A (1.38±0.0050), group C (1.32±0.0104), group D (1.33±0.0102) and group E (1.35±0.0319) but was nonsignificant ($P>0.05$) in group F (1.45±0.0120) on day 42. Present study showed that supplementation of dietary lead @ 200 mg/kg feed significantly ($P<0.05$) reduced the growth of broiler chickens in terms of ABW and FCR from other treatment groups but its effect on AFC was non significant ($P>0.05$) from others except group E which showed significant ($P<0.05$) increased AFC ($P<0.05$) at the end of 6 weeks (Table-1).

The above finding showed that ascorbic acid, α-tocopherol & Se and DL-methionine addition to the diet tended to reverse the depressive effect of lead on growth. However, the negative growth effect of lead was not fully overcome by the addition of methanolic extract of *Cissus quadrangularis* (CQE) at a dose of 400 mg/kg feed. Reduction in the body weight in poultry birds after the administration of lead at different dose level was reported by many workers[5-6-7]. The findings of the present study also corroborate the finding of Erdogan *et al*[8] indicating significant reduction in the body weight gain after feeding of lead acetate @ 200 mg/kg feed for 42 days further the addition of ascorbic acid enhanced the weight but had no significant effect on feed consumption and feed conversion ratio.

Table 1. Effect of lead and different treatment on feed consumption (g), body weight (g) and feed conversion from day old to 42 days in broiler chickens (n=21)

Days	Performance parameters	Various treatment groups showing mean ± SE values					
		A	B	C	D	E	F
1	ABW(g)	65.53±0.55^{b}	58.87±0.37^{a}	67.60±0.19^{c}	67.20±0.08^{c}	70.00±0.41^{d}	67.73±0.30^{c}
7	AFC (g)	68.00±0.41^{b}	96.14±0.30^{c}	99.46±0.21^{d}	104.13±0.42^{e}	65.57±0.38^{a}	98.38±0.24^{d}
	ABW (g)	162.00±0.41^{c}	153.45±0.35^{b}	151.20±0.45^{a}	169.60±0.43^{d}	168.80±0.51^{d}	162.80±0.16^{c}
	FCR	0.42±0.0014^{b}	0.63±0.0009^{e}	0.66±0.0006^{f}	0.61±0.0015^{d}	0.39±0.0010^{a}	0.60±0.0008^{c}
14	AFC (g)	131.19±1.52^{a}	182.66±4.28^{cd}	172.90±0.86^{c}	185.19±3.58^{d}	157.14±0.71^{b}	148.76±1.36^{b}
	ABW (g)	354.40±9.27^{ab}	336.90±7.14^{a}	346.27±4.00^{ab}	366.66±6.07^{b}	362.00±4.37^{ab}	343.20±2.51^{ab}
	FCR	0.37±0.0056^{a}	0.54±0.0060^{d}	0.50±0.0036^{c}	0.51±0.0060^{c}	0.43±0.0033^{b}	0.43±0.0021^{b}
21	AFC (g)	439.19±2.24^{b}	408.04±1.09^{a}	485.40±1.96^{c}	515.19±3.60^{d}	478.38±4.03^{c}	522.61±1.10^{d}
	ABW (g)	551.60±3.13^{cd}	475.00±1.78^{a}	540.00±4.08^{c}	576.08±3.56^{e}	561.25±3.55^{d}	496.11±2.20^{b}
	FCR	0.80±0.0029^{a}	0.86±0.0009^{b}	0.90±0.0037^{c}	0.89±0.0365^{c}	0.85±0.0035^{b}	1.05±0.0043^{d}
28	AFC (g)	920.90±2.81^{a}	1003.42±2.39^{b}	1037.37±6.12^{bc}	1055.19±16.77^{c}	1051.29±3.79^{c}	1044.80±6.80^{c}
	ABW (g)	880.43±1.96^{ab}	904.58±1.99^{b}	959.33±25.59^{c}	958.09±1.10^{c}	954.38±2.40^{c}	851.66±3.20^{a}
	FCR	1.05±0.0018^{a}	1.11±0.0002^{b}	1.08±0.0239^{ab}	1.10±0.0184^{ab}	1.10±0.0029^{ab}	1.23±0.0050^{c}
35	AFC (g)	1459.47±21.11^{a}	1625.09±35.83^{b}	1664.26±20.56^{b}	1669.95±40.14^{b}	1620.85±27.65^{b}	1567.00±30.62^{ab}
	ABW (g)	1236.19±23.80^{b}	1294.58±17.30^{bc}	1296.92±5.14^{bc}	1332.85±17.37^{c}	1309.51±6.78^{c}	1151.66±7.62^{a}
	FCR	1.18±0.0078^{a}	1.26±0.0310^{ab}	1.28±0.0110^{bc}	1.25±0.0135^{ab}	1.24±0.0151^{ab}	1.36±0.0184^{c}
42	AFC (g)	2331.23±34.27^{a}	2353.80±46.66^{a}	2354.47±17.43^{a}	2399.52±30.07^{ab}	2507.09±10.07^{b}	2330.86±29.25^{a}
	ABW (g)	1687.14±18.58^{b}	1602.49±10.77^{a}	1779.93±26.74^{c}	1798.57±9.09^{cd}	1859.37±3.93^{d}	1602.05±7.18^{a}
	FCR (g)	1.38±0.0050^{b}	1.47±0.0203^{c}	1.32±0.0104^{a}	1.33±0.0102^{ab}	1.35±0.0319^{ab}	1.45±0.0120^{c}

a-f Mean values bearing different superscripts within a row differ significantly at 5% (P<0.05) level between groups.

CONCLUSION

The current study showed that lead has a potent growth depressive effect on broilers although feed conversion ration (FCR) and average feed consumption (AFC) were not much affected at 200 mg of lead per kg of diet during the commercial rearing period of 42 days except vitamin-E & Se treated group which showed maximum average feed consumption and body weight growth. The above findings indicated that ascorbic acid, α-tocopherol & Se and DL-methionine addition to the diet tended to reverse the depressive effect of lead on growth with highest in DL-methionine followed by α-tocopherol & Se. However, least effect was showed by methanolic extract of *Cissus quadrangularis* (CQE) at a dose of 400 mg/kg feed. This indicated that the dose and /or route was insufficient for reversal of lead induced toxic effect and a higher dose of CQE in the diet would be more effective in overcoming the growth inhibitory effect of lead.

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