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AMELIORATIVE EFFECTS OF *WITHANIA SOMNIFERA* ROOT POWDER ON GROWTH PERFORMANCE IN LEAD TREATED CHICKENS

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ABSTRACT

The present study was carried out to evaluate the toxic effect of lead and protective efficacy of *Withania somnifera* root powder on the growth and performance of chickens for a period of 60 days. The general performance of birds was evaluated on the basis of clinical signs, average weekly body weight, feed consumption, body weight gain and feed conversion ratio (FCR). In control group (group I), birds were active and healthy and did not show any untoward clinical sign. While in 250 ppm (group II) and 400 ppm (group III) lead treated birds showed signs like dullness, depression, weakness, letharginess with loss of appetite. Loose droppings were seen in group III. Clinical signs were less severe with less number of birds affected in 250 ppm lead+WSRP (group IV) and 400 ppm+WSRP (group V) birds as compared to groups II and III. No mortality was seen in any of the group. A significant dose and time dependent decrease in body weight, feed consumption, body weight gain and significant increase in FCR were observed in groups II and III as compared to group I. However, in groups IV and V, a significant lesser decrease in body weight, feed consumption, body weight gain and significantly less increase in FCR observed as compared to groups II and III observed, respectively. The present investigation indicated the adverse effects of lead acetate on performance of broilers at 250 and 400 ppm and *Withania somnifera* root powder offering protection against lead toxicity in chickens.

Key word: Chickens, Growth performance, Lead, *Withania somnifera*

Lead is one of the ubiquitous environmental pollutants, particularly widespread in industrial areas that cause a broad range of physiological and biochemical dysfunctions in animals. Animals are exposed to lead from numerous sources like general environment, contaminated water sources, soil, feed etc. Environmental pollution caused by lead is a worldwide public health problem[1]. Earlier workers have stated that contamination of the environment with lead has reached to such a level that it can affect the growth, productivity and health in poultry also[2]. The sources of lead in poultry include feed ingredients and water.

Withania somnifera, commonly known as Ashwagandha or Indian Ginseng or Winter cherry, is an important Indian medicinal plant that has been widely used in ayurvedic and indigenous medicine for over 3,000 years[3]. The main constituents of this plant are alkaloids and steroidal lactones but the withanine, the main alkaloid found in its roots and leaves is thought to be responsible for its biological activity. This plant is known to have several medicinal properties including sedative, hypotensive, anti-aging, aphrodisiac, anti-inflammatory, bradycardia, respiration stimulatory, anti-tumour, antiperoxidative, cardiotonic, radiosensitizing and thyroregulatory effects[4,5,6,7,8,9]. Of all the parts, its roots have been considered to be the most effective for therapeutic

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purpose[10]. Present study thus was carried out to evaluate the ameliorative efficacy of *Withanis somnifera* root powder (WSRP) on growth and performance of lead treated chickens.

MATERIALS AND METHODS

One hundred and fifty day old broiler chicks were randomly divided into five groups of 30 birds each viz. group I (control), group II (250 ppm lead), group III (400 ppm lead), group IV (250 ppm lead + WSRP) and group V (400 ppm lead + WSRP). After two weeks of adaptation period, Groups II and III were administered 250 ppm and 400 ppm lead as lead acetate in triple glass distilled water respectively. Groups IV and V were administered 250 ppm and 400 ppm lead in triple glass distilled water along with *Withania somnifera* root powder orally in standard recommended feed at the rate of 1% concentration from 2 weeks of age of birds till 60 days post treatment (DPT). During the adaptation period of 2 weeks birds were given plain triple glass distilled water. In this study, clinical signs, body weight, feed consumption, body weight gain and feed conversion ratio were studied at 7 days intervals. Feed conversion ratio was calculated as per the formula mentioned below:

Feed conversion ratio (FCR)

$$= \frac{\text{Feed consumed (gm)}}{\text{Weight gain (gm)}}$$

Statistical analysis of data was done by using standard statistical procedures[11] with help of SPSS software 2007.

RESULTS AND DISCUSSION

In the present study, the clinical signs appeared 15 days post treatment (DPT) in groups II and III were dullness, depression, weakness, letharginess with loss of appetite. Loose droppings were seen in group III. In group I, birds were active and healthy and did not show any untoward clinical signs. Clinical signs were less severe with less number of birds affected in groups IV and V as compared to groups II and III. No mortality was seen in any of the group. Similar observations have already been were reported by earlier workers[12,13,14].

The performance of chickens in various groups with respect to overall body weight, feed consumption, body weight gain and feed conversion ratio are presented in table 1 to 4. The mean body weight in group I varied from 176.25±1.10 to 1249.25±1.49 and showed a significant increase at each time interval with peak at 60th DPT, whereas in groups II, III, IV and V, the mean body weight ranged from 176.25±1.31 to 1096.25±2.39, 176.30 ±0.75 to 981.00±1.35, 176.25±2.25 to 1191.50±2.98 and 176.30±3.14 to 1132.00±2.70, respectively with a significant increase from 0th DPT to 60th DPT. Groups II and III birds showed lower average weekly body weight throughout the experimental period when compared with group I. Present findings are similar to those reported by earlier workers in Japanese quail[15,16]. Lowered body weights in lead treated group birds could be due to decrease in the feed consumption or due to metabolic disorders associated with lead such as inhibition of enzymes involved in the heme synthesis and the oxidase system resulting in loss of cellular functions and tissue damage[17].

The average feed intake in groups I, II, III, IV and V ranged from 100±4.08 to 810±2.04, 80±4.08 to 750±2.82, 69±1.35 to 710±2.04, 100±2.04 to 785±1.91 and 90±3.53 to 760±2.88, respectively with a significant increase from 0 to 60th DPT in all the groups at different time intervals. The minimum feed intake was observed in the group III and maximum in group I. These observations suggest the dose dependent decrease in feed consumption during lead toxicity, which corroborates with the earlier findings in chicks[18], in domestic fowl[19], in rats[20] and in broilers[17]. Earlier workers have stated that decrease feed intake in the lead treated groups could be due to altered set point for feed consumption or decreased appetite[20].

The average body weight gain in groups I, II, III, IV and V, ranged from 73.75±2.28 to 200.25±2.25, 65.25±1.93 to 165.50±0.50, 61±1.95 to 130.50±4.94, 70.00±1.87 to 189.25±4.15 and 66.25±2.39 to 178.50±3.88, respectively. Reduction in the weight

gain in lead treated group in the present study may be due to influence of lead on feeding behavior via central nervous system[21] or its effect on secretion of growth hormone[22].

The feed conversion ratio in groups I, II, III, IV and V ranged from 1.35±0.02 to 4.04±0.05, 1.22±0.02 to 4.53±0.03, 1.13±0.05 to 5.46±0.20, 1.43±0.05 to 4.15±0.08 and 1.35±0.03 to 4.26±0.10, respectively. In present study, there was significant increase in FCR in groups II and III. Similar findings with respect to increased FCR in lead treated group birds were reported earlier[23].

Compared to groups II and III, weight gain, feed intake and body gain were better in birds treated concurrently with lead and WSRP. The protective effect of WSRP against adverse effects of lead on weight gain may be due to its anabolic effects[24]. Earlier workers have also noted significantly higher body weight in broiler chicks given *Withania somnifera* extract as compared to untreated birds[25,26].

Table 1. Average (Mean±SE) body weight (g) in different groups of experimental birds at different time intervals

Group / DPT	Group I	Group II	Group III	Group IV	Group V
0 DPT	176.25 ± 1.11^{Ia}	176.25 ± 1.32^{Ia}	176.30 ± 0.75^{Ia}	176.25 ± 2.25^{Ia}	176.30 ± 3.15^{Ia}
7th DPT	250.00 ± 1.63^{Ha}	241.50 ± 1.19^{Hcd}	237.25 ± 1.60^{Hd}	246.25 ± 1.25^{Hb}	242.50 ± 1.44^{Hbc}
14th DPT	349.00 ± 1.35^{Ga}	330.25 ± 1.84^{Gb}	318.75 ± 3.15^{Gc}	341.50 ± 3.38^{Ga}	332.25 ± 2.59^{Gb}
21st DPT	451.50 ± 0.96^{Fa}	422.75 ± 1.32^{Fc}	408.75 ± 3.15^{Fd}	442.00 ± 3.85^{Fb}	430.00 ± 3.54^{Fc}
28th DPT	579.25 ± 1.49^{Ea}	526.75 ± 1.97^{Ed}	506.25 ± 3.75^{Ee}	557.75 ± 1.32^{Eb}	538.25 ± 2.84^{Ec}
35th DPT	721.25 ± 1.25^{Da}	648.00 ± 2.94^{Dd}	616.50 ± 2.36^{De}	693.50 ± 3.95^{Db}	667.50 ± 1.44^{Dc}
42nd DPT	878.25 ± 1.18^{Ca}	778.50 ± 2.99^{Cd}	727.75 ± 1.32^{Ce}	843.50 ± 1.19^{Cb}	806.00 ± 2.45^{Cc}
49th DPT	1047.75 ± 1.32^{Ba}	930.75 ± 2.53^{Bd}	850.50 ± 4.50^{Be}	1002.25 ± 2.59^{Bb}	953.50 ± 2.72^{Bc}
60th DPT	1249.25 ± 1.49^{Aa}	1096.25 ± 2.39^{Ad}	981.00 ± 1.35^{Ae}	1191.50 ± 2.99^{Ab}	1132.00 ± 2.71^{Ac}

Different small letters (a, b, c, d and e) indicate significant (P<0.05) difference between groups on a particular day, whereas different capital letters (A, B, C, D, E, F, G, H and I) indicate significant (P<0.05) difference between days within a particular group.

Table 2. Average (Mean±SE) feed intake (g/bird/wk) in different groups of experimental birds at different time intervals

Group / DPT	Group I	Group II	Group III	Group IV	Group V
0-7th DPT	100 ± 4.08^{Ha}	80 ± 4.09^{Hb}	69 ± 1.35^{Hc}	100 ± 2.04^{Ha}	90 ± 3.54^{Ha}
7th-14th DPT	175 ± 2.04^{Ga}	140 ± 3.54^{Gc}	115 ± 3.54^{Gd}	180 ± 4.08^{Ga}	160 ± 5.40^{Gb}
14th-21st DPT	300 ± 0.00^{Fa}	270 ± 2.04^{Fc}	245 ± 2.12^{Fd}	300 ± 4.08^{Fa}	280 ± 3.54^{Fb}
21st-28th DPT	420 ± 5.40^{Ea}	380 ± 2.04^{Ec}	350 ± 0.00^{Ed}	400 ± 0.00^{Eb}	375 ± 1.92^{Ec}
28th-35th DPT	490 ± 7.07^{Da}	465 ± 1.23^{Db}	430 ± 5.40^{Dd}	470 ± 2.12^{Db}	440 ± 3.54^{Dc}
35th-42nd DPT	550 ± 2.04^{Ca}	510 ± 5.79^{Cc}	460 ± 2.04^{Cd}	530 ± 2.04^{Cb}	500 ± 3.54^{Cc}
42nd-49th DPT	670 ± 3.54^{Ba}	645 ± 1.92^{Bb}	605 ± 5.00^{Bd}	645 ± 2.89^{Bb}	630 ± 0.00^{Bc}
49th-60th DPT	810 ± 2.04^{Aa}	750 ± 2.83^{Ad}	710 ± 2.04^{Ae}	785 ± 1.92^{Ab}	760 ± 2.89^{Ac}

Different small letters (a, b, c, d and e) indicate significant (P<0.05) difference between groups on a particular day, whereas different capital letters (A, B, C, D, E, F, G and H) indicate significant (P<0.05) difference between days within a particular group.

Table 3. Average (Mean±SE) body weight gain (g/wk) in different groups of experimental birds at different time intervals

Group / DPT	Group I	Group II	Group III	Group IV	Group V
0-7th DPT	73.75±2.29^{Ga}	65.25±1.93^{Gbc}	61.00±1.96^{Ec}	70.00±1.87^{Fab}	66.25±2.39^{Fbc}
7th-14th DPT	99.00±2.80^{Fa}	88.75±2.75^{Fab}	81.50±4.44^{Db}	95.25±4.29^{Ea}	89.75±3.66^{Eab}
14th-21st DPT	102.50±2.26^{Fa}	92.50±2.99^{Fbc}	90.00±0.00^{CDc}	100.50±0.50^{Eab}	97.75±5.25^{DEbc}
21st-28th DPT	127.75±1.03^{Ea}	104.00±2.27^{Ebc}	97.50±5.95^{Cc}	115.75±4.72^{Dab}	108.25±6.10^{Dbc}
28th-35th DPT	142.00±1.23^{Da}	121.25±4.72^{Dcd}	110.25±4.66^{Bd}	135.75±4.05^{Cab}	129.25±3.61^{Cbc}
35th-42ndDPT	157.00±1.23^{Ca}	130.50±0.50^{Cb}	111.25±3.15^{Bc}	150.00±4.56^{Ba}	138.50±3.841^{BCb}
42nd-49thDPT	169.50±0.87^{Ba}	152.25±2.75^{Bbc}	122.5±5.20^{ABd}	158.75±2.39^{Bb}	147.50±2.10^{Bc}
49th-60th DPT	200.25±2.25^{A}a	165.50±0.50^{Ad}	130.5±4.94^{Ae}	189.25±4.15^{Ab}	178.50±3.88^{Ac}

Different small letters (a, b, c, d and e) indicate significant (P<0.05) difference between groups on a particular day, whereas different capital letters (A, B, C, D, E, F and G) indicate significant (P<0.05) difference between days within a particular group.

Table 4. Average (Mean±SE) feed conversion ratio in different groups of experimental birds at different time intervals

Group / DPT	Group I	Group II	Group III	Group IV	Group V
0-7th DPT	1.355±0.03^{Fa}	1.223±0.03^{Fb}	1.137±0.06^{Fb}	1.433±0.06^{Ea}	1.359±0.04^{Ea}
7th-14th DPT	1.772±0.06^{Eab}	1.584±0.08^{Ebc}	1.420±0.07^{Fc}	1.907±0.13^{Da}	1.795±0.12^{Dab}
14th-21st DPT	2.930±0.06^{Da}	2.928±0.09^{Da}	2.722±0.02^{Ea}	2.985±0.03^{Ca}	2.895±0.19^{Ca}
21st-28th DPT	3.288±0.04^{Ca}	3.659±0.08^{Ca}	3.630±0.22^{Da}	3.474±0.15^{Ba}	3.500±0.23^{Ba}
28th-35th DPT	3.450±0.06^{Bb}	3.852±0.15^{Ca}	3.920±0.16^{CDa}	3.472±0.11^{Bb}	3.414±0.12^{Bb}
35th-42nd DPT	3.504±0.03^{Bc}	3.909±0.05^{Cb}	4.146±0.13^{Ca}	3.543±0.11^{Bc}	3.620±0.12^{Bbc}
42nd-49th DPT	3.953±0.03^{Ab}	3.942±0.09^{Ba}	4.962±0.18^{Ba}	4.066±0.07^{Ab}	4.274±0.06^{Ab}
49th-60th DPT	4.047±0.05^{Ac}	4.532±0.03^{Ab}	5.464±0.20^{Aa}	4.153±0.08^{Ac}	4.265±0.11^{Abc}

Different small letters (a, b and c) indicate significant (P<0.05) difference between groups on a particular day, whereas different capital letters (A, B, C, D, E and F) indicate significant (P<0.05) difference between days within a particular group.

CONCLUSION

It was concluded from the present study *Withania somnifera* admintered orally @ 1% of the ration ameliorates the toxic effects of lead administered @ 250 and 400 ppm, on growth performance. The ameliorative effect on growth performance was more in birds administered 250 ppm of lead. *Withania somnifera* only admintered orally @ 1% of the ration.

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