IMMUNOPATHOLOGICAL EFFECT OF LEAD ACETATE ON HUMORAL AND CELL MEDIATED IMMUNE RESPONSES IN BROILERS*

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ABSTRACT

Lead acetate was given to group II and III broiler birds at dose level of 250 and 400 ppm from 2nd to 6th week while group I was served as control. Both humoral and cell mediated immune responses were evaluated in each group at the end of 6th week. Humoral immune responses were evaluated on the basis of HI titers against New Castle Disease viral antigen by beta procedure utilizing 4HA unit of LaSota strain. Cell mediated immune responses were evaluated using 2, 4, Dinitrochlorobenzene (DNCB) by skin hypersensitivity test in acetone vehicle. Six birds from each group were sacrificed at the end of 6th week and organ weights of bursa and thymus were recorded. Average log values of HI titers in group I were significantly higher than group II and III birds. Skin thickness (mm) and diameter area (cm) were found to be maximum at 24 hours post challenge in control and both treatment groups but differences between control and treatment group birds at 24 and 48 hours were found to be statistically significant. Both treatment group birds revealed significant decrease in bursa and thymus weights in dose dependent manner when compared with control group. Histopathological investigation of bursa and thymus in both treatment group birds revealed small size follicles with depletion of lymphoid population.

Key words: Lead acetate, immune organ, humoral immune responses, cell mediated immune re-

INTRODUCTION

Lead is an important environmental pollutant which exerts the adverse effect in animals, birds and man ranging from overt clinical signs referable to nervous, gastrointestinal and haematopoietic system to subtle effects such as immune dysfunction and oxidative damage (Radostits et al, 2003). Garg (2000) stated that lead produces central nervous system effects and is also irritating, immunosuppressive, genotoxic, nephrotoxic and toxic to the haematopoietic system. The immunotoxic effect of lead have been extensively reported in animals, however, the information on its immunopathological effect in birds is scanty. With a view to study the toxic effect of lead on immune system, present investigations were undertaken in broilers given lead acetate in drinking water by measuring humoral and cell mediated immune response in broilers.

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MATERIALS AND METHODS

The present investigations were carried out in the Department of Veterinary Pathology, PGIVAS, Akola. Seventy five, day old broiler chicks (Hubb, C & M Farming Ltd, Raipur) were randomly divided into three groups, each group thus comprising of 25 birds. Group I (control) birds were given commercial diet with normal drinking water while group II and III birds were given commercial diet with lead acetate in drinking water at 250 and 400 ppm levels respectively from 2nd to 6th week of age. Both humoral and cell mediated immune responses were evaluated in each group at the end of 6th week. Humoral immune responses were evaluated on the basis of HI titers against New Castle Disease viral antigen (LaSota strain) by beta procedure utilizing 4HA unit of LaSota strain. The HA unit of NCDV was determined by standard procedure using micro HA-HI titer as described by Allan & Gough (1974). Cell mediated immune responses were evaluated using 2, 4, Dinitrochlorobenzene (DNCB) by skin hypersensitivity test in acetone vehicle. Test was performed on six birds of each group as per the method described by Valsala et al. (1981). The thickness and diameter of skin lesions at the site of challenge indicating zone of reaction were measured at 0, 24 and 48 hours after challenging with DNCB solution using vernier caliper. Statistical analysis of data was done as per Snedecor and Cocharan (1994). Six birds from each group were sacrificed at the end of 6th week and organ weights of bursa and thymus were recorded. Tissues of bursa and thymus were collected in 10% formal saline for histopathological examination (Luna, 1968).

RESULTS AND DISCUSSION

For humoral immune responses, average log values of HI titers are given in Table 1. Mean values of HI titers in group I (8.10 ± 0.17) were significantly higher than group II (7.20 ± 0.08) and (6.70 ± 0.12) III birds. Similar findings of lower HI titers are reported by Youssef et al. (1996), Avadhesh Kumar et al. (1999) in lead treated birds and Trust et al. (1990) in Mallard ducks. Shukla et al. (2004) stated that decrease HI titers could be possibly due to lead induced apoptosis in avian lymphocytes leading to suppression of both CMI and HI responses. Youssef et al. (1996) opined that lower HI titers could be possibly due to decrease in number of IgM producing cells of spleen. Koller (1973) and Koller and Kovacic (1974) stated that there was a decrease in synthesis of IgG antibodies and also decrease in secondary immune response during lead toxicity.

Details of skin thickness and diameter of reactive skin lesions are given in Table 2. Skin thickness (mm) and diameter area (cm) were found to be maximum at 24 hours post challenge in control and both treatment group birds. Differences between control and treatmented birds at 24 and 48 hours were found to be statistically significant. The maximum skin thickness and diameter were observed in control birds (i.e. 2.20 ± 0.17 and 2.10 ± 0.40 respectively) followed by group II (1.84 ± 0.11 and 1.81 ± 0.80 respectively) and group III (1.65 ± 0.10 and 1.61 ± 0.08 respectively). Present observations of lower CMI responses during lead toxicity corroborate with the findings reported by Dey et al. (1994) and Avadhesh Kumar (1998). Decreased CMI response in lead exposed birds could be possibly due to lead induced apoptosis of lymphocyte or altered T cell activity as described by Shukla et al. (2004) and Dey et al. (1994) respectively.

Details of average of organ weights with their body weight ratio are depicted in table 3. Both treatment group birds revealed significant decrease in bursa and thymus weights in dose dependent manner when compared with control group. Present findings corroborate with those reported by Youssef et al. (1996). Lower weights of bursa and thymus in treatment group birds could be possibly due to lower body weights in these groups or direct toxic effect of lead on avian lymphocyte causing apoptosis and decrease in their number (Shukla et al., 2004.).
Histopathological investigation of bursa and thymus in both treatment group birds revealed small sized follicles with depletion of lymphoid population. Similar findings are reported by Chauhan et al. (1995) and Youssef et al. (1996).

Table 1:
Average Haemagglutination Inhibition titer in different groups. (Mean ± SE)

<table>
<thead>
<tr>
<th>HI titers</th>
<th>Treatment</th>
<th>Pooled Mean</th>
<th>‘F’ test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>II</td>
<td>III</td>
</tr>
<tr>
<td></td>
<td>8.10c ± 0.17</td>
<td>7.20b ± 0.08</td>
<td>6.70a ± 0.12</td>
</tr>
</tbody>
</table>

Mean values with common alphabet as superscript do not differ significantly

** Significant at 1% level.

Table 2:
Cutaneous Delayed Hypersensitivity Response to 2,4-Dinitrochlorobenzene in different groups : Biometry of skin thickness and diameter of spreading lesions (Mean ± SE)

<table>
<thead>
<tr>
<th>Group</th>
<th>Thickness of Skin (mm)</th>
<th>Pooled Mean</th>
<th>Diameter of spreading lesions (cm)</th>
<th>Pooled Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 Hrs.</td>
<td>24 Hrs.</td>
<td>48 Hrs.</td>
<td>0 Hrs.</td>
</tr>
<tr>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.21 ± 0.05</td>
<td>3.25 ± 0.34</td>
<td>2.13 ± 0.12</td>
<td>2.20c ± 0.17</td>
</tr>
<tr>
<td>II</td>
<td>1.23 ± 0.04</td>
<td>2.38 ± 0.14</td>
<td>1.90 ± 0.16</td>
<td>1.84b ± 0.11</td>
</tr>
<tr>
<td>III</td>
<td>1.20 ± 0.04</td>
<td>2.03 ± 0.11</td>
<td>1.72 ± 0.14</td>
<td>1.65a ± 0.10</td>
</tr>
</tbody>
</table>

Mean values with common alphabet as superscript do not differ significantly
Table 3: Average Bursa and Thymus weights (gms) with body weight ratio (Mean ± SE)

<table>
<thead>
<tr>
<th>Group</th>
<th>Bursa</th>
<th>Thymus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average absolute Weight</td>
<td>Bursa body weight ratio</td>
</tr>
<tr>
<td>I</td>
<td>2.64c ± 0.20</td>
<td>0.191c ± 0.021</td>
</tr>
<tr>
<td>II</td>
<td>2.07b ± 0.15</td>
<td>0.160b ± 0.011</td>
</tr>
<tr>
<td>III</td>
<td>1.60a ± 0.06</td>
<td>0.115a ± 0.007</td>
</tr>
<tr>
<td>Pooled Mean</td>
<td>2.10 ± 0.14</td>
<td>0.155 ± 0.013</td>
</tr>
</tbody>
</table>

F test: ** ** ** **

Mean values with common alphabet as superscript do not differ significantly.

** = Significant at 1% level.

It is thus concluded that lead acetate in broilers causes suppression of both HI and CMI responses.

REFERENCES


