SHORT COMMUNICATION:
THE ROLE OF CALCIUM: PHOSPHORUS IMBALANCE IN THE DEVELOPMENT OF TIBIOTARSAL ROTATION IN OSTRICH (STRUHTHO CAMELUS) AND EMU (DROMAIUS NOVAEHOLLANDIAE) CHICKS

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ABSTRACT
Leg deformities comprise one of the main causes of chick mortality in all ratite rearing countries. In this study, the clinical manifestations of tibiotarsal rotation were described and sera were analyzed for the concentrations of total protein, cholesterol, calcium, phosphorus, manganese and copper, and for activities of aspartate aminotransferase (AST) and creatine kinase (CK) in affected and control ostrich and emus chicks. Serum calcium concentration was lower (p<0.05) in affected chicks than control chicks. Ca: P ratio in the diet fed to the chicks was also found to be imbalanced (4.3). After correction of the Ca: P ratio to 2:1, a remarkable improvement was noticed in the incidence of leg deformities among the ratite chicks in the farm.

INTRODUCTION
In ostrich and emu chicks, leg deformities such as slipped tendon, splayed legs, valgus rotation, twisted or rolled toes, clubbed foot, osteomalacia and rickets have been described by (Huchzermeyer, 1998). Some of these leg deformities were described in chicks raised in two big ostrich projects in Saudi Arabia (Agab, 2005). Tibiotarsal rotation is a common condition in ratite chicks and is characterized by deformity of the coxo-femoral joint due to rotation of the tibiotarsal bone above the hock joint leading to turning of the foot to the outside. Severely affected chicks...
cannot stand and thus injure the hock joint by rubbing it on the concrete floor while attempting to stand up. Consequently, affected birds find difficulty to reach food and water troughs and eventually die of starvation or wound infection (Gilslider, 1994; Cooper and Gimbi, 1994). Genetics, nutrition, lack of enough exercise and high growth rates of young chicks associated with overfeeding of high protein diets are the causes of limb deformity (Bruning and Dolensenk, 1986; Reece and Butler, 1984).

The present study investigated the effects of calcium:phosphorus imbalance on serobiochemical parameters and control of the condition in ostrich and emu chicks.

MATERIALS AND METHODS

A private farm containing 400 ostriches (Struthio camelus) and 400 emus (Dromaius novaehollandiae) as a breeding stock for meat production was established in the central region of Saudi Arabia. About 15% of the chick crop developed leg deformities (Fig. 1 and 2) around the second to the sixth week post hatch. Most of the cases (approximately 75%) were diagnosed as tibiotarsal-rotated leg deformed chicks on the basis of clinical and patho-anatomical observations. Clinically, the affected birds were divided into two groups: Severely affected birds were those recumbent or crawled leg-deformed birds while the moderately affected ones were those which could still walk despite the clear deformity.
Fig. (1): Tibiotarsal Rotation in an Ostrich Chick
Serum samples were collected from affected ostrich and emu chicks as well as healthy control chicks. The numbers of serum samples collected from severely affected birds, moderately affected birds and control were 16, 13 and 10, respectively. Sera were analyzed for the concentrations of total protein, cholesterol, calcium, phosphorus, manganese and copper and for the activities of aspartate aminotransferase (AST) and creatine kinase (CK) using commercial kits (Boehringer Mannheim Diagnostics and Wako Chemicals, GmbH, Germany) as described by (Mushi et al., 1999).

The data were subjected to statistical analysis using one-way analysis of variance (ANOVA).

RESULTS AND DISCUSSION

The results of serobiochemical alterations are summarized in (Table 1). Calcium concentration showed the greatest variation and was lower (p<0.05) in affected than healthy birds. Although affected chicks tended to have higher serum total protein and cholesterol concentrations than control, no statistically significant difference (P>0.05) between the groups was observed. This result was in accord with the finding of (Palomeque et al., 1991, Costa et al., 1993 and Nahid et al., 2006). Neither AST nor CK activity showed significant differences among the groups. However, the creatine kinase (CK) activity was tended to increase in the affected chicks. The diet fed to chicks was analyzed and results presented in (Table 2). As can be seen in (Table 2), a Ca: P ratio of 4:3 was fed to the chicks and considered a gross deviation from the recommended ratio of 2:1 for the first few weeks, and became 3 – 4 : 1 as the birds grow (Angel et al., 1996). Protein concentration in the ration was also high within the allowed limits (Cilliers et al., 1995).

Table (1): Serobiochemical parameters of tibiotarsal-rotated ostrich and emu chicks

<table>
<thead>
<tr>
<th>Group</th>
<th>No. of samples</th>
<th>Ca (mg/dl)</th>
<th>P (mg/dl)</th>
<th>Mn (ppm)</th>
<th>Cu (ppm)</th>
<th>Total protein (g/dl)</th>
<th>Cholesterol (mg/dl)</th>
<th>AST (IU)</th>
<th>CPK (IU)</th>
</tr>
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<tr>
<td>Severe</td>
<td>16</td>
<td>8.77</td>
<td>±</td>
<td>5.24</td>
<td>±</td>
<td>6.28</td>
<td>63</td>
<td>5.15</td>
<td>27.1</td>
</tr>
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</table>
Management factors mandated that decision to alter the ration upon light of this information could only be taken in the following breeding season. Thus, Ca : P ratio was altered in the starter ration fed to chicks to become approximately 2 : 1 by increasing calcium supply. The new ration had dramatic effect on the incidence of leg deformity during the last season. The overall incidence of leg deformity was reduced to 3%, only about 20% of which were diagnosed as tibiotarsal rotation conditions.

In addition to Ca: P imbalances, a high protein diet is oftenly fed to commercial ratites in order to achieve fast weight gain (Deeming et al., 1993). This practice, together with the lack of enough exercise appears to be the underlying cause of the increasing incidence of leg deformity in captive ratites (Bezuidenhout and Burger, 1993). Leg deformity has, so far, not been recorded in wild birds. One of us (B. Abbas) has handled hundreds of wild born ostrich chicks in efforts exerted to rehabilitate the ostrich during the civil war crisis in southern Sudan, and no cases of leg deformity were encountered.

REFERENCES


