Age Effect on Selected Biochemical Parameters of Ostriches Reared in Captive Condition in India

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Abstract  
In this work the biochemical parameters in ostrich serum at different age groups in Indian climatic condition was assessed. Serum was analyzed for parameters such as total protein, albumin, globulin, calcium, phosphorus, cholesterol, triglycerides and lipoprotein. The serum calcium, phosphorus and low density lipoprotein (LDL) showed significant variation at different ages. It is observed that age played a significant role in the serum calcium and phosphorus values and birds with low serum calcium and phosphorus may be prone for limb related deformities.

Key words: Ostrich, Age groups, Biochemical parameters, Captivity, Indian climatic condition.

1. Introduction  
Ostrich is the largest, flightless and heaviest living bird in the world, belonging to the ratite family. The ostrich has one of the most advanced immune systems known to mankind. It has remarkable tolerance to heat, withstanding temperature of 56°C without undue stress. Ostriches are reared mostly for their large variety of products such as egg, egg shell, feather, hide, meat and oil. Ostrich farming has been witnessing major changes for the past two decades. It has been undergoing ups and downs worldwide. In India, ostrich farming is relatively new and has been in existence only for the past 10 years. The only organized ostrich farm in India is located at Postgraduate Research Institute in Animal Sciences, Kattupakkam. Management of these birds in general, particularly the young chicks, is still relatively difficult. The management systems are yet to be standardized in many parts of the world.

The blood biochemical values are known to be influenced by various factors such as age, body condition, diet, diseases, management, nutrition and sex etc. The values are useful for diagnosis of disease and illness in birds. The parameters also provide highly valuable information on physiological status and allow the detection of possible diseases. Ostriches in general are difficult to handle especially the juvenile birds. General health can be monitored by assessing their vital biochemical parameters. It is more compelling in ostriches as they are difficult to handle and require more attention in their health status. There is very little understanding on the blood serum profile of ostriches. It is necessary to have standard values and knowledge of their variation in relation to age, blood collection methods, season, physiological status, sex, and other factors for proper evaluation of metabolic profiles. However, very little research work had been done on biochemical parameters of ostrich influenced by age. Hence to arrive at the base line values, present work has been designed and carried out.

2. Materials and Methods  
2.1 Geographical Location  
Ostriches reared under standard managemental conditions at Post Graduate Research Institute in Animal Sciences, Kattupakkam were used for our study.

2.2 Age of Birds  
Blood was collected from ostriches of age one to twelve months with two month’s interval (2, 4, 6, 8, 10 and 12 months) and thereafter in adult birds in the age group of (24-36 months). All the birds were maintained in standard management condition and raised in fenced paddocks.

2.3 Collection of Blood  
Morning time (7.30 - 9.00A.M) was utilized for blood collection. Birds were restrained with their wings and face was covered with a black colored hood. Blood
was collected by vein puncture from the brachial vein (wing) because of its larger size. Pressure was applied to raise the vein. Three milliliters of blood was collected from all 42 birds using a 5 ml syringe. One ml was taken in vials containing Ethylene Diamine Tetra Acetic Acid (EDTA). Remaining blood was undisturbed for two hours for separation of serum.

2.4 Lab Analysis

Blood analysis was carried out within four hours of collection. The biochemical parameters were estimated using A 15 Biosystem auto analyzer with commercially available kits from AGAPPE.

3. Results and Discussion

The data recorded during the conduct of the experiment were grouped, analyzed systematically and presented in their respective Tables. The analysis of variance of the same is also presented as annexure.

3.1 Effect of age on Serum Total Protein (g/dl)

The influence of age on Serum Total Protein is presented in Table 1. Age of the bird had no significant effect on serum total protein. The value ranged from 2.99 ± 0.07g/dl to 4.39 ± 0.30 g/dl and 3.82 ± 0.23 g/dl to 3.62 ± 0.18 g/dl in different age groups. The overall average value of total protein in different age groups observed in our study was 3.74 g/dl, which is similar to the reported values of Levi et al. (1989); Okotie-Eboh et al. (1992); Moniello et al. (2005); Miranda et al. (2006) and Omidí and Nik (2012). However, Chen et al. (2011) observed lower values, while higher values were recorded by Palomeque et al. (1991); Quintavalla et al. (2001); Verstappen et al. (2002); Moniello et al. (2006) Hassim et al. (2006) and Bonadiman et al. (2009). The effect of age on serum total protein in our study does not reveal any significant, which is similar to that of the findings of Palomeque et al. (1991); Moniello et al. (2005) and Chen et al. (2011). Contrary findings were observed by Levi et al. (1989) and Durgun et al. (2005). Researcher who had studied the effect age on serum total protein in other species such as Emu (Menon et al., 2013), Pheasant (Kececi et al., 2011), Turkey (Szabo et al., 2005) were in contrary to the present findings.

3.3 Effect of age on the Serum Globulin (g/dl)

The influence of age on serum globulin is presented in Table 1. The values of serum globulin in the age groups studied were not significantly different. The range of values of serum globulin was 1.13 ± 0.13g/dl to 2.26 ± 0.18 g/dl indifferent age groups. The overall average value of serum globulin observed in our study was 1.64 g/dl. Contrary to our findings, higher values were observed by Okotie et al. (1992); Durgun et al. (2005); Ahmed et al. (2006); Hassim et al. (2006); Miranda et al. (2008); Bonadiman et al. (2009); Martinez et al. (2010) and Omidí and Nik (2012). Lower values were observed by Chen et al. (2011) and Selvan et al. (2012). The effect of age on serum globulin in our study does not reveal any significance, which is similar to that of the findings of Durgun et al. (2005) and contrary to Chen et al. (2011). Researcher who had studied the effect age on serum globulin in other species such as Emu (Menon et al., 2013), Turkey (Szabo et al., 2005) was in contrary to the present findings.

3.4 Effect of age on Serum Calcium (mg/dl)

The influence of age on serum calcium is presented in Table 1. Significant (P<0.01) differences were observed in calcium values of different age groups. The values of serum calcium indicated no conclusive trend. The lowest value was observed in the age group of 6 months (5.92 ± 0.72 mg/dl) and the highest value was observed in 24- 36 months of age (9.21 ± 0.48 mg/dl). The values obtained in other age groups were more or less comparable with each other. The overall average value of different age group in serum calcium observed in our study was 8.69 mg/dl. Contrary to our findings, Palomeque et al. (1991); Quintavalla et al. (2001); Agaoglu et al. (2003) and Martinez et al. (2010) reported higher serum calcium levels. The effect of serum calcium on age did not reveal any specific trends; the lowest calcium level was recorded in the age group of 6 months. Contrary to our-

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Table 1: Effect of age on Serum Total Protein, Albumin, Globulin, calcium, phosphorus, cholesterol, triglyceride, LDL, HDL in ostrich (Mean ±SE)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>2 (n=12)</th>
<th>4 (n=12)</th>
<th>6 (n=12)</th>
<th>8 (n=12)</th>
<th>10 (n=12)</th>
<th>12 (n=12)</th>
<th>24-36 (n=12)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serum Globulin** (g/dl)</td>
<td>3.60±0.44</td>
<td>3.72±0.56</td>
<td>2.99±0.07</td>
<td>4.27±0.54</td>
<td>3.82±0.19</td>
<td>3.39±0.20</td>
<td>4.39±0.30</td>
</tr>
<tr>
<td>Serum triglyceride (mg/dl)</td>
<td>2.18±0.19</td>
<td>2.03±0.17</td>
<td>1.86±0.12</td>
<td>2.04±0.08</td>
<td>2.34±0.21</td>
<td>2.10±0.09</td>
<td>2.13±0.18</td>
</tr>
<tr>
<td>LDL** (mg/dl)</td>
<td>1.42±0.25</td>
<td>1.69±0.47</td>
<td>1.13±0.13</td>
<td>2.22±0.53</td>
<td>1.47±0.10</td>
<td>1.29±0.13</td>
<td>2.26±0.18</td>
</tr>
<tr>
<td>Serum Calcium** (mg/dl)</td>
<td>7.42±0.91</td>
<td>8.41±0.48</td>
<td>5.92±0.72</td>
<td>6.58±0.18</td>
<td>7.88±0.50</td>
<td>6.74±0.60</td>
<td>9.21±0.48</td>
</tr>
<tr>
<td>Serum phosphorus** (mg/dl)</td>
<td>7.66±6.34</td>
<td>8.57±1.44</td>
<td>5.30±0.82</td>
<td>7.86±0.21</td>
<td>6.35±0.28</td>
<td>5.49±0.64</td>
<td>4.96±0.39</td>
</tr>
<tr>
<td>Serum Cholesterol** (mg/dl)</td>
<td>152.66±15.5</td>
<td>120.50±4.57</td>
<td>132.50±19.41</td>
<td>131.50±12.94</td>
<td>129.50±11.58</td>
<td>114.16±14.01</td>
<td>95.16±19.77</td>
</tr>
<tr>
<td>Serum triglyceride** (mg/dl)</td>
<td>201.83±14.2</td>
<td>155.33±9.36</td>
<td>165.00±6.21</td>
<td>179.66±14.23</td>
<td>254.83±39.36</td>
<td>239.16±51.72</td>
<td>231.16±44.64</td>
</tr>
<tr>
<td>LDL** (mg/dl)</td>
<td>32.66±1.80</td>
<td>20.33±2.40</td>
<td>38.66±2.71</td>
<td>20.00±2.06</td>
<td>14.08±1.01</td>
<td>9.33±1.42</td>
<td>15.66±3.20</td>
</tr>
<tr>
<td>HDL** (mg/dl)</td>
<td>63.90±9.93</td>
<td>44.95±0.88</td>
<td>61.48±4.42</td>
<td>56.53±6.83</td>
<td>58.68±8.20</td>
<td>47.85±12.12</td>
<td>33.81±12.87</td>
</tr>
</tbody>
</table>

**. Highly significant (P<0.01), *. Significant (P<0.05) and NS- Not significant; Mean values sharing any one common superscript in a row for age and sex do not differ significantly.

findings, Palomeque et al. (1991) observed that young ostriches had significantly lower calcium levels than the older group. Quintavalla et al. (2001) reported that the calcium level remains almost constant in one of the experiment. Simpraga et al. (2004) reported that the level of calcium to be 2.33 mmol/L in day old ostriches. Mohri et al. (2009) observed that most of the blood parameters did not show any significant difference. Reissig et al. (2002) in Lesser Rhea observed that the value of blood parameters increases with increase in age. Similarly, Silva et al. (2007) observed significantly difference in broilers in the age group of 30 to 42 days.

3.5 Effect of age on Serum Phosphorus (mg/dl)

The Influence of age on serum phosphorus is presented in Table 1. Significant (P<0.01) differences were observed in the phosphorus values of different age groups. The values indicated no conclusive trend. The lowest value of serum phosphorus was observed in the age of 24-36 months (4.96 ± 0.39 mg/dl) and highest value was observed in the age of 4 months (8.57 ± 1.44 mg/dl). The values obtained in the age of 24-36 months were comparable with the values of 6 and 12 months of age (5.30 ± 0.82 mg/dl and 5.49 ± 0.64 mg/dl respectively). The overall average value of different age group in serum phosphorus observed in our study was 6.57mg/dl. Verstappen et al. (2002) reported that the value of inorganic phosphate to be 1.3 to 2.3 mmol/L, which is much lower than the value obtained in our study. However, Agaoglu (2003) reported the value of phosphorus in clinically healthy ostriches to be 6.4 mg/dl, which is similar to findings recorded in our study. Simpraga et al. (2004) reported the value of phosphorus in day old ostrich chicks to be 4.56 mmol/L. Martinez et al. (2010) observed a higher level of phosphorus in ostrich birds at 10.29 mg/dl. Age played a significant role in determining the phosphorus level in ostriches between 2 months and above. As in the case of calcium, highest level of phosphorus was seen in 6 months of age and the lowest was seen in 12 months of age. Okotie-Eboh et al. (1992) observed that the phosphorus decreased with increase in age. Ahmed et al. (2006) reported the value of inorganic phosphorus to be 5.8 mg/dl in adult birds which is lower than the results obtained in our study. Yalcin et al. (2004) observed that the age did not influence the said parameter, unlike our findings.

3.6 Effect of age on Serum Cholesterol (mg/dl)

The influence of age on serum cholesterol is presented in Table 1. Age had no significant effect on serum cholesterol levels. The serum cholesterol value indicated lower value with increase in age group (152.66 ± 15.58 mg/dl in 2 months vs 95.16 ± 19.77 mg/dl in 24-36 months). The overall average value of different age groups in serum cholesterol observed in our study was 125.14mg/dl. Lower values were recorded by Levi et al. (1989); Palomeque et al.(1991); Okotie-Eboh et al. (1992); Durgun et al. (2005); Moniello et al. (2005; 2006); Hassim et al. (2006); Bonadiman et al. (2009) Selvan et al. (2012) and Omidi and Nik (2012); Much higher value was recorded by Miranda et al. (2008). The effect of age on serum cholesterol in our study does not show any significant difference, which is similar to that of the
findings of Levi et al. (1989); Palomeque et al. (1991); Durgun et al. (2005) and Moniello et al. (2005). Researcher who had studied the effect of age on serum cholesterol in other species such as Emu (Menon et al., 2013) and Pheasant (Kececi et al., 2011) was in contrary to the present findings.

3.7 Effect of age on Serum Triglyceride (mg/dl)

The influence of age on Serum Triglyceride is presented in Table 1 No significant effect on Serum Triglyceride value was observed among different age groups. The value observed in serum Triglyceride in 4 months of age indicated the lowest value 155.33 ± 9.36 mg/dl and the highest value was observed in the age group of 10 months (254.83 ± 39.36 mg/dl). The overall average value of serum triglyceride observed in our study was 203.85mg/dl. Lower values were observed by Levi et al. (1989); Okotie-Eboh et al. (1992); Durgun et al. (2005); Moniello et al. (2005; 2006); Miranda et al. (2008) and Omidi and Nik (2012). The effect of age on serum triglyceride does not show any significant difference, which is similar to that of the findings of Moniello et al. (2005). Levi et al. (1989) had contrary findings. Researcher who had studied the effect age on serum triglyceride in other species such as Emu (Menon et al., 2013) and Pheasant (Kececi et al., 2011) were in contrary to the present findings.

3.8 Effect of age on Low Density Lipoprotein (mg/dl)

The influence of age on low density lipoprotein is presented in Table 1. The value was highest (38.66 ± 2.71mg/dl) in 6 months of age and lowest (9.33 ± 1.42mg/dl) in 12 months of age. No specific trend was observed. The overall average value of low density lipoprotein observed in our study was 21.53mg/dl which is similar to finding of Omidi and Nik (2012), whereas higher value was observed by Miranda et al. (2008). The overall average value of low density lipoprotein observed in our study was 52.43mg/dl. Lower value of 26.13 mg/dl was observed by Omidi and Nik (2012), whereas higher value of 134 mg/dl was observed by Miranda et al. (2008).

3.9 Effect of age on High Density Lipoprotein (mg/dl)

The influence of age on high density lipoprotein is presented in Table 1. The high density lipoprotein values in different age groups were not significantly affected. The value of high density lipoprotein ranged from 33.81 ± 12.87mg/dl in 24-36 months to 63.90 ± 9.93mg/dl in the age group of 2 months. The value decreased with increase in age group. The high density lipoprotein values in different age groups were not significantly affected. The value of high density lipoprotein ranged from 33.81 ± 12.87mg/dl in 24-36 months to 63.90 ± 9.93mg/dl in the age group of 2 months. The value decreased with increase in age group.

4. Summary and Conclusion

Age played a significant role in the serum calcium and phosphorus values. Serum calcium (mg/dl) was in favour of 24 to 36 months aged birds (9.21) and the lowest value was seen in the birds of 6 months of age (5.92). Similarly the phosphorus value was also in favour 6 months birds (5.30) and the lowest was seen in the birds of age 24 – 36 months of age (4.96). No significant differences were observed between the age groups. The total protein (g/dl) was in the range of 2.99 to 4.39. The albumin (g/dl) was in the range of 1.86 to 2.34. The range of values observed in globulin (g/dl) was 1.13 to 2.26. The cholesterol was in the range of 95.16 in 24 to 36 months of age to 152.66 in 2 months of age. The triglyceride was in the range of 155.33 to 254.83. Age played a significant role in LDL in favour of 2 month (32.66) and 6 month (38.66). Lower values were recorded in 12 months of age (9.33). The values obtained were comparable with each other in other age groups.

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