Influence of type of nest and time of egg collection on ostrich hatchability, embryonic mortality and microbial contamination

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ABSTRACT


Ninety eggs were collected over a period of four months from thirteen ostriches that were intensively reared at PGRIAS, Katupakkam, TANUVAS, to study factors such as type of nest and time of egg collection that could influence hatchability, embryonic mortality, malposition and microbial contamination in ostrich eggs. Eggs laid in mud nest had significantly (P<0.01) higher total and fertile hatchability and lower embryonic mortality. Out of nine dead-in-shells five of them had embryonic malpositions in eggs laid on grass nest. Hatchability was significantly (P<0.05) more in eggs collected in afternoon with a lower embryonic mortality rate. Eggs collected during forenoon had significantly (P<0.01) higher microbial load of 1.01±0.01 log cfu/g on the shell than eggs collected in the afternoon. Eggs collected from grass nest had significantly (P<0.01) higher microbial count on the shell and content than eggs collected from mud nest. Eggs collected during the afternoon had significantly (P<0.01) lower microbial count in egg content. Based on this study, it is concluded that eggs laid in mud nest at afternoon has higher hatchability and embryonic mortality with lower microbial contamination.

Key words: Egg collection, embryonic mortality, hatchability, nest, Ostrich

INTRODUCTION

The ostrich egg is unusual for its large size, ranging between 1000-2000 g, averaging at approximately 1500 g. The success of ostrich farming depends largely on the production of fertile eggs. Artificial incubation has become an essential part of the commercial ostrich farming, but our understanding of artificial incubation in ostriches is still poor when compared to domesticated poultry. Scientific reports of fertility and hatchability of artificially incubated ostrich eggs in different countries show that hatchability results are highly variable. Eggshell thickness, high pore density, deficient cuticle deposition and low eggshell strength are associated with low hatchability and high embryonic mortality during artificial incubation. Unfortunately very limited studies have been conducted on this aspect all over the world, while in India it is just beginning. Very meagre work has been recorded on time of egg collection and various types of nest can influence hatchability and embryonic mortality. Against this background, the objectives of this study was to study the influence of type of nest and egg collection time on hatchability, embryonic mortality, malpositions and microbial contamination of ostrich eggs.

MATERIALS AND METHODS

Eggs from ostriches reared under the same environmental and managamental conditions were utilized. Each bird was identified by its tag number and paddock number. Ninety eggs were collected over a period of four months from thirteen ostriches that were intensively reared at PGRIAS, Katupakkam, TANUVAS, to study factors such as type of nest and time of egg collection that could influence hatchability, embryonic mortality, embryonic malposition and microbial contamination in ostrich eggs. Nest site used by each bird was identified. Swabs were taken from eggs laid and each egg was collected aseptically. Eggs were collected daily and time of egg collection was noted. Eggs were collected twice a day and based on time of collection it was categorised as forenoon (9 am-12 pm) and afternoon (12 pm-7 pm). Some of the eggs collected in forenoon had been laid after 7 pm of the previous day. Eggs were set after providing required storage period of zero to seven days. On the day of hatch, live chicks were weighed; swabs were taken from hatched egg shell and its content. Based on the number of eggs set and chicks hatched, total and fertile hatchability was calculated. Unhatched eggs were collected hygienically and studied for type of embryonic mortality (early, late and dead in shell), swabs were obtained for microbiological study. The collected unhatched eggs were broke open at their broad end and checked for any changes. It was considered that eggs without any visible growth or changes as infertile, a dark spot on yolk with area of pellucid and area opaca as early embryonic mortality, a fully grown embryo which had not hatched as dead-in-shell and rest with visible growth as late embryonic mortality. Infertility was recorded as a proportion of egg set and percent fertile eggs was arrived at. According to the stage of foetal development, embryonic death was categorised as early, mid, late and dead-in-shell, and embryonic malpositions were observed. Embryonic mortality was expressed as percent of fertile eggs within factors studied. Later, swabs
were taken from the surface of hatched egg and egg content using 1% sterile PBS solution.

The data were subjected to statistical analysis as per Snedecor and Cochran (1994). MS-Excel and SPSS (20, SPSS Inc., Chicago, USA) software was used for interpretation using Chi square test then Duncan’s multiple comparison test (Duncan, 1955)

RESULTS AND DISCUSSION

Effect of type of nest

The influence of nest type on total and fertile hatchability is presented in Table 1. Fertile egg numbers were almost equal in both the groups. As no physiological factor was involved, analysis for percent fertility was irrelevant. The total hatchability of eggs laid in mud was high (48.39±0.09) and was highly significant (P<0.01). A significant (P<0.05) difference in the fertile hatchability was also observed between nest types with highest fertile hatchability in mud nest (75.00±0.03). Percent total hatchability showed highly significant (P<0.01) difference between grass and mud nest. The fertile hatchability also showed a significant (P<0.05) difference between the two nest types. This agreed with the finding of Deeming (1996a). Deeming (1995a) had suggested that there should be an improvement in the nest hygiene of ostrich and proposed addition of coarse sand as a suitable substrate in the nest. Kirund and Muwereza (2011) who had studied the effect of various nest material in chicken disagreed with our finding that sand nest gave better hatchability.

Deeming (1995b and 1997) had stated that wet nest site could be the cause for higher microbial contamination. Since no literature was readily available on the effect of nest material on the hatchability of ostrich eggs it could only be assumed that dew that had fallen on the grass during the study period could have made the grass wet, and the change in temperature may have caused higher penetration of bacteria into the ostrich shell which is poorly adapted to prevent microbial contamination in damp soiled environment (Deeming, 1996a). Also as per the study of Van Schalkwyk (1999) sand has been described as a good heat absorber and could become cool at night and even during rainy weather drainage would be better in a sand nest rather than in a grass nest.

The influence of type of nest on embryonic mortality and malpositions are furnished in Table 2. No significant difference was observed in late embryonic mortality but there was a significant (P<0.05) difference in dead-in-shell embryos. Percent dead-in-shell in grass nest was 40.91±0.11, but in mud nest the percent dead-in-shell was only 20.00±0.09. Embryonic malposition was high in grass nest with more number of embryos with malpositions of beak at equatorial presentation. No significant difference were observed in total embryonic mortality between the two type of nest studied, but significant (P<0.05) difference was noticed in percent dead-in-shell in grass nest (40.91±0.11%). This agrees with findings of Deeming (1995a and 1997) were contaminated nests had resulted in higher dead-in-shell. As per Hoyt et al. (1978) during the first phase of incubation there is an exponential increase in growth then a decline of about 25% and finally the rate of oxygen consumption just before pipping and this raise may coincident with internal pipping. An ostrich chick just before pipping requires extra strength and energy, but in a heavily contaminated environment it may not able to use maximum muscular force to pip and break out. This could have resulted in increase dead-in-shell mortality in eggs laid on grass nest.

Out of nine dead-in-shells five of them had embryonic malpositions in eggs laid on grass nest. Again the turning of chick required more energy as its foot had to kick its way out from the side of the egg instead of cutting the top of egg (Sauer and Sauer, 1996; Deeming 1995). There are many factors that affect this turning however, under a highly contaminated environment within the shell these chicks most probably would not have had the strength to turn and pip due to muscular fatigue and myopathy (Cooper et al., 2001).

Effect due to time of egg collection

The effect of egg collection time on total and fertile hatchability is presented in Table 3. The number of fertile eggs out of total number of eggs at forenoon was four times higher (50.00±1.02) than afternoon (28.57±1.25) study period. The percentage total hatchability was significantly (P<0.05) higher in morning as compared to afternoon. This may be related to the fact that eggs are more matured in morning time (Sauer and Sauer, 1996; Deeming 1995). It is better to collect eggs in the morning so that they could complete their incubation period in the evening.
out of 18 and in the afternoon it was 38 out of 72 eggs. As no physiological factor was involved, analysis for percent fertility was irrelevant. Total hatchability percentage was significantly (P<0.05), higher in eggs collected during afternoon (27.78±0.06) than eggs collected in the forenoon, but percent fertile hatchability was not significant between the two collection periods. Eggs collected during the afternoon between 12 pm-7 pm had significantly (P<0.05) higher total hatchability. This agreed with the finding of Stewart (1996), Van Schalkwyk (1999) and the finding of Zakaria et al. (2009) who studied the same in chicken, while Berrang et al. (1997) disagreed with the above findings. Although eggs were collected within two hours of laying, some eggs which were laid after 7 pm were collected in the morning of the next day. This would have exposed the eggs to day time temperature and solar radiation for longer period of time eventually resulting in lowered hatchability.

Effect of egg collection time on embryonic mortality and malpositions is presented in Table 4. Eggs collected in the afternoon had more number of dead-in-shell embryos and the same was observed with embryonic malpositions also. No significant difference was observed in percent embryonic mortality with regards to time of egg collection, although numerically, percent total embryonic mortality was higher in egg collected during forenoon. This agrees with the finding of Van Schalkwyk (1999) who also observed that eggs collected in afternoon had slightly lower embryonic mortality while Fasenka et al. (1999) who did their work in broilers, disagreed with this above finding. As suggested by Labaque et al. (2004) Rhea eggs need to be collected regularly for good hatchability as late collection of eggs from nest had some initial embryonic growth under environmental condition and when later placed in a storage temperature of 17°C could lead to embryonic mortality. Number of
Table 4: Effect of time of egg collection of ostrich eggs and its influence on embryonic mortality and malposition

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Forenoon</th>
<th>Afternoon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total embryonic mortality</td>
<td>2</td>
<td>13</td>
</tr>
<tr>
<td>Percent total embryonic mortality</td>
<td>NS 50.00±0.29</td>
<td>34.21±0.11</td>
</tr>
<tr>
<td>Embryonic mortality</td>
<td>Early and Mid -</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Late</td>
<td>0</td>
</tr>
<tr>
<td>Percent late embryonic mortality</td>
<td>NS 0</td>
<td>05.26±0.04</td>
</tr>
<tr>
<td>Dead-in-shell</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Percent dead-in-shell</td>
<td>50.00±0.29</td>
<td>28.95±0.07</td>
</tr>
<tr>
<td>Embryonic malposition</td>
<td>Beak at equatorial 0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Beak at narrow end 1</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 5: Influence of time of egg collection and type of nest on microbial load (log cfu/g)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Time of egg collection</th>
<th>Type of nest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Forenoon (9 am to 12 pm)</td>
<td>Afternoon (12 pm to 7 pm)</td>
</tr>
<tr>
<td>Total no. of eggs</td>
<td>18</td>
<td>72</td>
</tr>
<tr>
<td>Total contaminated eggs</td>
<td>12</td>
<td>25</td>
</tr>
<tr>
<td>Percent contaminated eggs</td>
<td>66.67b</td>
<td>34.72a</td>
</tr>
<tr>
<td>Total Plate Count (on shell)</td>
<td>1.01±0.01</td>
<td>2.29±0.03</td>
</tr>
<tr>
<td>(in content)</td>
<td>1.0±0.03</td>
<td>1.33±0.04</td>
</tr>
</tbody>
</table>

Means with different subscripts differ significantly (P<0.01) within rows.

Malpositions was found to be higher in eggs collected in the afternoon. Eggs were collected within one hour after lay in the afternoon and no possible explanation could be traced from any literature with regard to this finding. 

Microbial load on and in ostrich egg

Microbial load on the shell and in the contents of the egg is presented in Table 5. Eggs collected during forenoon had significantly (P<0.01) higher microbial load of 1.01±0.01 cfu/g on the shell than eggs collected in the afternoon. Eggs collected from grass nest had significantly (P<0.01) higher microbial count on the shell than eggs collected from mud nest. Eggs collected during the afternoon had significantly (P<0.01) lower microbial count in egg content. Egg laid in grass nest had significantly (P<0.01) higher microbial load in the egg content than eggs laid in the mud nest.

Type of nest did not have any influence on percent contamination of egg collected from ostriches. Forenoon collected eggs were significantly more contaminated to afternoon collected eggs, Van Schalkwyk (1999) agreed with the above finding as he also observed that egg collected in afternoon had lower egg contamination.

Although eggs were collected within one hour of egg laid. Some of the morning eggs would have been eggs laid after 7 pm of the previous day. As it has been stated by Deeming (1995, 1996a and 1996b) the degree of contamination of the nest was heavy and more time spent in this contaminated environment would have increased bacterial penetration into the shell. As the study was conducted during October to March climatic conditions could have further contributed for higher contamination due to the early morning dew. Deeming (1995) had also advised that collection should be timed accordingly to minimise the period spent in the nest particularly when the weather is wet, as this could enhance microbial penetration.

It could be concluded that mud nest would be the obvious choice for ostrich to lay their eggs when compared to grass nest as hatchability was higher. It was also observed that ostrich tends to lay more eggs between 12 pm to 7 pm and if collected immediately there could be higher hatchability. Although eggs were collected within one hour of egg laid some of the morning eggs would have been eggs laid after 7 pm of the previous day and this could be attributed for the higher microbial load.

REFERENCES


