Assessment of hatchability of Tunisian local turkey compared to commercial turkey and its relationships with physical egg traits

A. Djebbi* N. M’Hamdi and B. Haddad

Laboratory of animal and food resources, National Agronomic Institute of Tunisia

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ABSTRACT

A study was conducted to evaluate the hatchability of local turkey compared to commercial turkey eggs, and its relationships with physical egg traits. A total of 410 local turkey eggs and 252 commercial turkey eggs were used for this study and the data were submitted to analysis of variance. Average fertility (%) and fertile egg hatchability (%) were significantly (P<0.05) lower in local turkeys compared to commercial turkeys. Furthermore, infertile eggs (%), early-, mid-, and late-period deaths during incubation were higher in the local turkeys compared to the commercial turkeys. Embryo mortality occurred mainly 27th and 28th of incubation. Based in this result, hatchability of turkey local eggs was very low when compared with commercial turkey eggs; this reduction resulted in part from a high rate of infertility, embryonic mortality caused by poor management system and genotype. The results of effect of physical egg traits (weight, shell thickness, maximum width and length) on hatchability showed no significant effect on percentage hatchability of fertile eggs (>0.05). Hatchability was affected by egg shape index.

Key words: Eggs, Embryo mortality, Fertility, Hatchability, Turkey.

INTRODUCTION

In Tunisia, the local turkey (Melagris gallopavo) existed mainly in rural regions, contributed meaningfully to meat and egg production and consumption in developing countries. However, this local population persists, with limited numbers per contribution to the chicken population (FAO, 2011). This low production is due to the susceptibility of this animal to certain diseases (Marchewka et al., 2013), poor reproductive performance (Zahraddeen et al., 2011), and hatchery problems etc.

However, reproduction of turkey cannot be considered as an isolated entity, it is influenced by factors related to fertility and hatchability of egg. These two major parameters are influenced by genetic and environmental factors (King’ori, 2011). Lower hatchability can be observed in a flock of embryo mortality is higher and fertility is lower. Embryo mortality can affect 33% of fertile eggs in traditional chickens (Hocking et al., 2007). Physical characteristics of eggs play an important role in the processes of embryo development and successful hatching. The most influential egg parameters are: weight, shell thickness, shape index, breadth and length (Narushin and Romanov, 2002). Unfortunately, in Tunisia, research on local turkey is very limited. Hatching Characteristics of eggs should be studied as they will be used in the production system for better performance. This work was designed to evaluate the hatchability of Tunisian local turkey compared to commercial turkey and its relationships with physical egg traits.

MATERIALS AND METHODS

The experiment was carried out for four months (December, January, February and March) at turkey farm in Boussalem, government area of Jandouba, Tunisia, the tropical climate of Region North West of Tunisia has a mean annual rainfall ranges from 1000 mm- 1500 mm. The ambient temperatures ranges from 25° C à 30° C during the dry season and 5° C à 10° C during the rainy season.

The local and commercial (Hybrid) turkeys were at an age of 36 to 40 weeks. The local turkeys were managed traditionally based on semi intensive management system (partial confinement and partial day scavenging). The commercial turkeys (Hybrid), were reared under intensive system, and offered a standard commercial diet and water was provided ad libitum. A total of 410 and 252 eggs were collected from the local and commercial turkeys, respectively. Eggs were stored over a period of seven days. The eggs were first subjected to physical analysis like egg weight, length, width, and shape index and shell thickness. All eggs were incubated at a temperature of 37.5 °C and relative humidity of 55% for the period from 1 until 24 days of incubation with a turning three times daily. Eggs were transferred to hatching trays on the 25th day of incubation. The temperature and relative humidity were 37 °C and 69%, respectively.
respectively. Fertility and early embryo mortality were recorded on the 7th and 14th day of incubation by candling. Hatchability was recorded and eggs not hatched were opened to record late embryo mortality. Embryonic mortalities were classified into early phase (EPEM) (0 - 12d), middle phase (MPEM) (13 - 24d), late phase (LPEM) (25 - 28d). Hatching results were calculated according to the formulae given below.

Fertility rate (%) = (number of fertile eggs / number of set eggs) x 100

Hatchability of fertile eggs (%) = (number of hatched chicks / number of fertile eggs) x 100

Rate of early embryonic mortality (%) = (number of early embryonic mortalities / total number of fertile eggs) x 100

Rate of middle embryonic mortality (%) = (number of middle embryonic mortalities / total number of fertile eggs) x 100

Rate of late embryonic mortality (%) = (number of late embryonic mortalities / total number of fertile eggs) x 100

**Statistical analysis:** Data on fertility, hatchability and embryo mortality rate were subjected to analysis of variance (ANOVA) to examine whether any difference exists between groups under each experiment using XLSTAT. Significant difference was used at 0.05 probability level and differences between groups were tested by the Duncan’s test at the levels of significance.

**RESULTS AND DISCUSSION**

**Hatchability parameters:** As shown in Table 1, the mean percentage of fertility, fertile egg hatchability, infertile egg and embryonic mortality of local turkey compared to commercial turkey eggs. The effects of management system and genetic group on fertility and hatchability were a high significant differences (P<0.05). The percentage of fertile egg (%) in local and commercial turkeys was found 75.60% and 96.82%, respectively. The highest fertile egg percentage was found in commercial turkeys followed by local turkeys and the value differed significantly between them. The percentage of fertile egg hatchability (%) in local and commercial turkeys was found 74.19% and 90.16%, respectively. The lower fertile egg hatchability percentage was found in local turkeys. Similarly, Ellob et al. (2009) reported that lower hatchability in Bronze turkey compared to Hybrid. The effect of genotype observed corresponds with findings of Ndofor-Foleng et al. (2015).

![Distribution patterns of embryo mortality on consecutive incubation days](image)

**Fig-1:** Distribution patterns of embryo mortality on consecutive incubation days

<table>
<thead>
<tr>
<th>Traits</th>
<th>Local turkey</th>
<th>Commercial turkey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>410</td>
<td>252</td>
</tr>
<tr>
<td>Fertility</td>
<td>310</td>
<td>244</td>
</tr>
<tr>
<td>Fertile egg hatchability</td>
<td>230</td>
<td>220</td>
</tr>
<tr>
<td>Infertile Egg</td>
<td>100</td>
<td>8</td>
</tr>
<tr>
<td>EPEM</td>
<td>20</td>
<td>6</td>
</tr>
<tr>
<td>MPEM</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>LPEM</td>
<td>50</td>
<td>10</td>
</tr>
</tbody>
</table>

EPEM=Early period embryonic mortality (%); MPEM=Middle period embryonic mortality (%); LPEM=Late period embryonic mortality (%); a,b means in the same row with different superscripts are significantly different P<0.05

The mean percentages of infertile eggs (%) in local and commercial turkeys were 24.39 % and 3.17%, respectively. The mean infertile eggs of local turkey obtained in the present study is lower with the findings of Anna Anandh et al. (2012) who reported the mean infertile eggs of turkey was 29.37%, were reared under semi intensive system of management. The highest percentage of infertile eggs was found in local turkeys. In this study, a higher percentage of infertile eggs were obtained to that of Mroz et al. (2010) who reported that the percentage of infertile eggs was low in turkey, but may reach 10% at the beginning and towards the end of the laying season. Based on this result, low fertility and hatchability values have been reported in traditional and
semi intensive management system. The commercial turkey undergoes a balanced diet (intensive system). But the local turkey selected for this study was collected from semi intensive farms. In this system of breeding, the turkey has access to get food during their scavenging. the effect of management system observed corresponds with findings of Anna Anandh et al. (2012).

The lower hatching rate of fertile eggs observed in local turkeys compared to commercial strains is mainly due to embryonic mortality during incubation. The highest embryo mortality rates of local turkey were noted at the late stage of incubation (16.12%), lower mortality rates were reported at the first (6.45%) and second incubation stage (3.87%). The highest mortality reported in this experiment was agreed than noted by Anna Anandh and Richard Jagatheesan (2015) that the high mortality occurred during late periods of incubation. Hocking et al. (2007) also reported that high embryonic mortalities values were found in traditional management system.

The pattern of distribution of embryonic mortality on successive incubation days is shown in Figure 1. The first peak of mortality in local and commercial turkeys was observed up to incubation day 5; the values were 1.93% and 1.22%, respectively. The second highest mortality in the local turkeys group was noted on the last day of incubation (27th and 28th day), and the 27th day of incubation for commercial turkeys. The results of the current study are in agreement with those of Mroz et al. (2007), who stated that the first peak of embryo mortality is observed between the incubation day 3 and 6, and the second between day 26 and 28. At the first incubation stage, peak mortality is mainly due to a stoppage of development, were observed during the period of blood island formation. At the last incubation stage, the predominant symptoms of the dead embryos in the shell were the malposition (9.35%) in local turkey, than in the other strain only one malpositioned. The incidence of malpositioning in turkey eggs was attributed that genetic factors (Sharaf et al, 2010).

**Hatchability and physical egg trait:** Egg quality is considered one of the most important factors affecting hatchability of turkey eggs due to increasing embryonic mortality during pipping and hatching. Mean values for egg weight, length, width, shell thickness and shape index are presented in Table 2, for the hatched and unhatched groups of eggs. There was no significant difference between hatched and unhatched eggs for the initial egg weight, egg length and egg width. According to Alabi et al. (2012), the lower hatchability is influenced by egg weight during incubation. Eggshell thickness was also no significantly different between hatched and unhatched groups of eggs. This result agrees with Yamak et al. (2016), but disagrees with that of Huwaida et al. (2015). Egg shape index was significantly different (p <0.05) between hatched and unhatched groups of eggs. The highest values being presented by hatched eggs (71.14%). Unhatched eggs were recorded in shape index form 69.24%. This result is in agreement with the findings of Alasahan and Copur (2016). In contrast to previous research suggesting that the egg shape index does not affect hatchability (Sari et al., 2010; Lotfi et al., 2011; Taha, 2011).

**CONCLUSION**

The fertility, hatchability and embryo mortality of local turkey are a complex phenomenon’s influenced by a variety of genotype, and management system. In this study, the lower hatchability in poor management farm was due mainly to higher late death percentage and infertile eggs rate. During local turkey farming in Tunisia, management techniques have been developed which are more applicable to the conditions of the farmers; however, it is possible to adapt or develop innovative technologies to improve the general characteristics of production.

**REFERENCES**


Table 2: Means±S.E. of hatched and non-hatched turkey eggs physical characteristics.

<table>
<thead>
<tr>
<th>Egg physical characteristics</th>
<th>Hatched</th>
<th>Unhatched</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egg weight (g)</td>
<td>83.13±6.72a</td>
<td>82.24±6.67a</td>
</tr>
<tr>
<td>Egg length (mm)</td>
<td>66.60±2.81a</td>
<td>68.80±7.63a</td>
</tr>
<tr>
<td>Egg width (mm)</td>
<td>47.33±1.26a</td>
<td>47.22±1.20a</td>
</tr>
<tr>
<td>Eggshell thickness (mm)</td>
<td>0.48±0.065a</td>
<td>0.50±0.060a</td>
</tr>
<tr>
<td>Egg shape index, %</td>
<td>71.14±2.52a</td>
<td>69.24±5.95b</td>
</tr>
</tbody>
</table>

*a,b means in the same row with different superscripts are significantly different P<0.05.*


