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Reproductive performance of Beltsville small White and Broad Breasted Bronze Turkeys (*Meleagris gallopavo*) under hot humid climatic condition

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ABSTRACT

The study was conducted to compare the reproductive performance of Beltsville Small White and Broad Breasted Bronze turkeys (*Meleagris gallopavo*) under the hot humid climatic condition. Beltsville Small White and Broad Breasted Bronze turkeys were raised in an intensive production system under standard management practices. A total of 560 Beltsville Small White turkey eggs and 520 Broad Breasted Bronze turkey eggs were used for this study. Average egg weight (g), infertile eggs (%), early embryonic mortality (%), late embryonic mortality (%), dead in shell (%) and poults hatched weight (g) were significantly (P>0.01) higher in Broad Breasted Bronze turkeys as compared to Beltsville Small White turkeys. The total hatchability (%), fertile egg hatchability (%) and poults survivability (%) were (P>0.01) significantly higher in Beltsville Small White turkeys as compared to Broad Breasted Bronze turkeys. Non significantly higher fertility percentage was observed in Beltsville Small White turkeys as compared to Broad Breasted Bronze turkeys. It is concluded that Beltsville Small White turkeys are more suitable to obtain better reproductive performance under hot humid climate condition followed by Broad Breasted Bronze turkeys.

Key words: Beltsville small white, Broad breasted bronze, Egg weight, Fertility, Hatchability, Poults, Turkey.

INTRODUCTION

Turkey *(Meleagris gallopavo)* occupies an important position next to chicken, duck, guinea fowl and quail. Turkey farming is very popular in western countries and is in infancy in India. At present turkey farming is gaining attention in India and is getting popular fast in southern regions as well, but yet to be exploited with proper scientific approaches. There are three varieties of turkey commonly available in India. They are Broad breasted bronze, Broad breasted white and Beltsville small white. One of the main objectives in turkey production is to increase the number of poults produced. It was reported that egg yield, egg fertility and hatchability were usually lower compared to that in other poultry species and successful turkey breeding primarily requires the determination of factors that affect hatchability. The production cost of poults can be lowered by increasing egg yield, fertilization capacity and hatchability. In addition, low egg yield, unsatisfactory egg fertility and hatchability constitute a major problem for breeding enterprises (Ozcelik *et al.,* 2009). Fertility and hatchability are the major determinant of profitability in the hatchery enterprise (Peters *et al*., 2008). These parameters appear to be very important as far as parent stocks are kept to produce final hybrids. Hatchability is a complex age dependent trait. It has been reported that the hatchability of medium sized turkey eggs is better than that of small or large eggs (Brunson and Godfrey, 1953). It has been determined that heavy eggs have a higher last-phase-death-rate in broilers than lighter eggs (Reinhart and Hurnik, 1984; Ogunshile and Sparks, 1995). The same phenomenon has been observed in turkey eggs (Reinhart and Moran, 1979). Therefore, turkey breeding programmes are searching for ways of increasing the number of poults by increasing the number of eggs for hatching produced by each turkey. The reproductive performance of available turkey varieties should be studied as they will be used in the production system for better performance. This study was therefore conducted to compare the fertility, hatchability and associated traits among Beltsville Small White and Broad Breasted Bronze Turkeys under hot humid climatic condition of Tamil Nadu.

MATERIALS AND METHODS

Experimental birds and management: The study was conducted at Turkey Research Unit of Tamil Nadu Veterinary and Animal Sciences University - Regional Research Centre, Pudukkottai, Tamil Nadu, India. Beltsville Small White and Broad Breasted Bronze turkeys were raised in an intensive

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system of management and the birds were maintained under standard management practices. Free mating was used in the flock and the ratio of males to females was 1:4. A commercial turkey breeder mash (Table 1) was fed *ad libitum* to the birds and fresh water was made available *ad libitum* to the birds throughout the day. Beltsville Small White and Broad Breasted Bronze turkeys all at 34 to 36 weeks of age were used in this study.

Incubation and hatching: A total of 560 eggs of Beltsville Small White and 520 eggs of Broad Breasted Bronze were collected, randomly selected and weighed. The collected eggs were stored at room temperature for 3-5 days and then kept for incubation. Proper cleaning, disinfection and fumigation were conducted before setting of eggs. The temperature of 99.5^0F in dry bulb and relative humidity of 87.0^0F in wet bulb were set to incubate the eggs for 25 days during which they were rotated hourly interval. Thereafter, these eggs were transferred to the hatcher, where a temperature 98.5^0F in dry bulb and relative humidity of 90.0^0F in wet bulb were maintained. Hatching started on the day 27 and was completed by the end of day 28. All the unhatched eggs were opened to determine cause of hatching failures.

Weight measurement: Egg weight was determined before setting by using an electronic scale. All turkey poults were weighted at hatch with a electronic scale.

Reproductive performance evaluation: At the end of hatching process, egg were classified as infertile, hatched, embryonic mortalities and dead in shell. The embryonic mortalities were then grouped as early and late depending upon the size of the dead embryos after opening un-hatched eggs. Hatched poults were collected, counted and weighed by using an electronic scale. Reproductive performances included total egg hatchability, fertile egg hatchability and fertility and than were calculated using the following standard formula.

$$\text{Total egg hatchability} = \frac{\text{Poults hatched}}{\text{Total eggs set}} \text{X } 100$$

$$\text{Fertile egg hatchability} = \frac{\text{Poults hatched}}{\text{Fertile eggs set}} \text{X } 100$$

$$\text{Fertility} = \frac{\text{Total eggs set} - \text{Infertile eggs}}{\text{Total eggs set}} \text{x } 100$$

Statistical analysis: The data generated from each experimental group were analyzed statistically by following standard procedures (Snedecor and Cochran, 1989) for comparing the means and to determine the effect of turkey variety on reproductive performance.

RESULTS AND DISCUSSION

Average egg weight (g), percentage of infertile eggs, embryonic mortalities, dead in shell, total egg hatchability, fertile egg hatchability, fertility and poults hatched weight of Beltsville Small White and Broad Breasted Bronze turkeys are presented in Table 2. The mean average egg weight (g) in the Beltsville Small White and Broad Breasted Bronze turkeys was 69.79±0.01 and 71.21±0.01, respectively. Broad Breasted Bronze turkeys produced higher egg weight as compared to Beltsville Small White turkeys. The average egg weight between both turkeys varieties differ significantly. This result is in accordance with the findings of Ozcelik *et al*. (2009) who reported the mean weight of turkey eggs ranged 67.4 to 70.3 g.

The mean percentage of infertile eggs (%) in the Beltsville Small White and Broad Breasted Bronze turkeys was 7.08±0.01 and 7.60±0.04, respectively. Non significantly the higher percentages of infertile eggs were found in Broad Breasted Bronze turkeys followed by Beltsville Small White turkeys. Low percentage of infertile eggs in Beltsville Small White turkeys might be due to lower egg weight as compared to higher egg weight of Broad Breasted Bronze turkeys. Mroz

TABLE 1: Ingredients and nutrient contents of turkey layer mash

Ingredients	Inclusion level (%)
Maize	40.00
Cumbu	20.00
De oiled rice bran	19.00
Soya bean meal	08.00
Dry fish	08.50
Mineral mixture	01.50
Shell grit	03.00
Nutrient contents	
Crude protein (%)	15.15
Metabolizable energy (kcal/kg)	2750
Calcium (%)	04.04
Phosphorus (%)	00.89
Lysine (%)	00.81
Methionine (%)	00.31

TABLE 2: Reproductive performance of Beltsville Small White and Broad Breasted Bronze turkeys (Mean ± SE)

Reproductive traits	Beltsville Small White	Broad Breasted Bronze
Average egg weight (g)	69.79±0.01^a	71.21±0.01^b
Infertile eggs (%)	7.08±0.01^{NS}	7.60±0.04^{NS}
Early embryonic mortality (%)	2.26±0.04^a	4.09±0.03^b
Late embryonic mortality (%)	2.63±0.01^a	4.81±0.01^b
Dead in shell (%)	6.07±0.03^a	9.18±0.04^b
Total hatchability (%)	81.78±0.01^a	73.44±0.01^b
Fertile egg hatchability (%)	87.43±0.01^a	79.15±0.01^b
Fertility (%)	92.93±0.02^{NS}	92.44±0.05^{NS}
Poults hatched weight (g)	45.59±0.08^a	47.27±0.08^b
Poults survivability (%)	95.56±0.17^a	96.14±0.12^b

Means bearing different superscripts row- wise differ significantly (P<0.01).

et al. (2010) reported that the percentage of infertile eggs was low in turkeys, but may reach 10% at the beginning and towards the end of the laying season.

The mean percentage of early and late embryonic mortalities (%) in the Beltsville Small White and Broad Breasted Bronze turkeys were found to be 2.26±0.04 and 4.09±0.03 and 2.63±0.01 and 4.81±0.01, respectively. The percentages of early and late embryonic mortalities significantly lower in Beltsville Small White turkeys as compared to Broad Breasted Bronze turkeys. Differences in eggshell characteristics could influence embryonic mortality during incubation and consequently hatching success. Egg size has been associated with embryonic mortalities (Sewalem and Wilhelmson, 1999). As egg size increases the shell quality decreases, which may contribute to increased embryonic development. Krueger (1993) reported that embryonic mortalities of Large White commercial turkey breeder hens varied from 6 to 13% of all fertile eggs while the late mortality was 1.5 to 2%.

The mean percentage of dead in shell (%) in the Beltsville Small White and Broad Breasted Bronze turkeys was 6.07±0.03 and 9.18±0.04, respectively. The highest percentage of dead in shell were found in Broad Breasted Bronze turkeys followed by Beltsville Small White turkeys and dead in shell percentage of both turkey varieties differed significantly between them. The percentage of dead in shell increased as the weight of egg increased in both turkey varieties. An explanation for increased dead in shell due to increasing egg size was that larger eggs would be expected to have greater difficulty initially achieving adequate embryonic temperature and then losing embryonic metabolic heat during later stage of incubation. The higher heat production and more difficulty of heat dissipation in large eggs has been found to result in higher embryo temperatures in large eggs (Altan *et al*. (1995).

The mean percentage of total egg hatchability (%) in the Beltsville Small White and Broad Breasted Bronze turkey was found 81.78±0.01 and 73.44±0.01, respectively. The highest total egg hatchability percentage was found in Beltsville Small White turkeys followed by Broad Breasted Bronze turkeys and the value differed significantly between them. The mean percentage of fertile egg hatchability (%) in the Beltsville Small White and Broad Breasted Bronze turkeys was found 87.43±0.01 and 79.15±0.01, respectively. The higher fertile egg hatchability percentage was found in Beltsville Small White turkeys followed by Broad Breasted Bronze turkeys. The fertile egg hatchability between turkeys varieties differ significantly. The mean percentage of fertility in the Beltsville Small White and Broad Breasted Bronze turkeys were 92.93±0.02 and 92.44±0.05, respectively and the values were significantly different. Maximum hatching results can be obtained from heavy eggs weight. Sachdev *et al.* (1985) reported that hatchability of fertile eggs and fertility rate in quail were found higher in heavy hen eggs than in light weight eggs. Similarly, Altan *et al.* (1995) reported that fertility rate, hatchability of all eggs set or fertile eggs in quail were higher in heavy weight eggs compared to light eggs. It has been reported that hatchability of turkey eggs is maximum with eggs weighing between 70 - 85.5 g (Karacanta *et al.* 1977). The effect of egg size on hatchability was explained by Deeming (1997) who observed that the effect of egg size on hatchability was due to a reduction in the surface area to volume ratio with increasing egg size making the gas heat exchange more difficult. The present findings are in conformity with above findings.

The mean percentage of poults hatched weight in the Beltsville Small White and Broad Breasted Bronze turkeys were found 45.59±0.08 and 47.27±0.08 %, respectively. Poults hatched weight of turkey varieties differ significantly. Poults hatched weight increased in line to increase in hatching egg weight. The positive correlation was found between egg weight and the hatching weight indicated the advantage of initial bigger size egg at the time of setting. This result is similar to the finding of Altan *et al.* (1995). The rate of poults hatched weight to the hatching egg weight was 63.5 % in turkeys (Shanaway, 1987).

The mean percentage of poults survivability in the Beltsville Small White and Broad Breasted Bronze turkeys was found 95.56±0.1 and 96.14±0.12 %, respectively. The highest percentage of poults survivability was found in Broad Breasted Bronze turkeys followed by Beltsville Small White turkeys. Turkey poults survivability of both turkey varieties differ significantly between them.

CONCLUSION

From these results it can be concluded that Beltsville Small White turkeys are more suitable to obtain better reproductive performance under hot humid climatic condition then the Broad Breasted Bronze turkeys.

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