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Effect of genotype on fertility and hatchability traits of F_1 locally-adapted turkey of Nigeria

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Abstract

A total of 78 one day-old random-bred Nigerian local turkey poults were used to produce another 232 day-old poults in two planned experiments to characterize and discriminate Nigerian local turkey based on fertility and hatchability traits. Three phenotypic classes (black, white and spotted) were obtained as base population and used to generate F_1 progeny. Experimental design was a randomized complete block (RCBD) with phenotypic class as major factor of interest and hatches as block. Results showed that there was significant difference ($p<0.05$) in the fertility (%) of the phenotypic classes, with spotted turkeys having the highest value of 80.51%. The black turkey has significantly ($p<0.05$) highest hatchability of fertile eggs (74.91%) and hatchability of eggs set (62.20%) when compared with the white and spotted varieties. Peeped percent was significantly ($p<0.05$) lowest in the white turkeys (0.00%). There was significant difference ($p<0.05$) in the dead in shell percent of the phenotypic classes, with black and spotted turkeys having the lower values of 28.66% and 28.59% to compare with the white turkeys with the highest dead in shell (44.09%).Spotted and black phenotypes exhibited greater performance in fertility traits including hatchability of fertile eggs (%) among the three phenotypic groups. It is recommended that the spotted phenotype should be selected by breeders to achieve improved fertility, hatchability and production. Also management of eggs during incubation should be improved to increase the hatchability of eggs.

Keywords: local turkey, fertility and hatchability traits

Introduction

In Nigeria, local turkey production is generally low as a result of poor fertility and hatchability. Low egg production and hatchability which is usually observed on breeder turkey is of concern to the poultry industry. Low egg production and hatchability which is usually observed on breeder turkey is of concern to the poultry industry.Also, the fertility and hatchability of local turkey and their associated traits have not been vigorously established.

Currently, total poultry population in Nigeria is estimated to be about 172 million out of which chicken is estimated at 160 million, guinea fowl (8.3 million), ducks (1.7 million) and local turkeys (1.05 million) (FAOSTAT, 2011). Although turkeys were introduced in Africa several decades back by the Christian missionaries, till date turkey farming has achieved very little progress and low popularity (Singh and Sharma, 2005). Indigenous poultry species are hardy and generally adapt favourably to the local environment (Ikeobi, 2003). The carcasses of turkey contain a high percentage of protein, low saturated fats, low in cholesterol, highest in

methionine and essential amino acids required for complete protein usage than chicken.

Turkey (*Meleagris gallopavo*) is becoming popular in Nigeria due to its capacity to expand the poultry subsector and help to supply meat and eggs.In spite of all these attributes, local turkeys have poor growth performance, low egg production and low fertility (Zahrudden *et al.*, 2011). Local turkey is becoming few in Nigeria and are predominantly the bronze-black type raised extensively (Oluyemi and Roberts, 2000).

The main purpose of animal breeding practices is to improve traits of economic value (Mendes,*et al.*, 2005) and body weight is one of those important economic traits in the selection of animals.

Fertility and hatchability are major parameters in reproduction performance which are most sensitive to environmental factors and genetic influence (Stromberg, 1975). Fertility is the ability to reproduce (Modupe, 2013) and determines the number of offspring that can be obtained from a given number of eggs. It is the most important determinant for producing more poults for a given number of breeding stocks within a stipulated period (Islam *et al.*, 2002). In turkey, fertility and hatchability are lowly heritable traits, compared to chicken. Hawes *et al.* (2007) reported fertility rate of 70-80% in local/heritage turkeys. According to Wischart *et al*. (2001) fertile eggs are eggs that are capable of hatching and that fertility of local turkey range from 70-83% over 16 weeks of breeding seasons and hatchability rate of 70-84% of fertile turkey eggs which is lower than the exotic breed 80-90%. The broad objective of the study is to evaluate the effect of phenotype on fertility and hatchability traits of F_1 locally-adapted turkey of Nigeria.

Materials and methods

The study was conducted at the Poultry Unit of the Teaching and Research Farm of the Michael Okpara University of Agriculture, Umudike, Abia State. Umudike is located on latitude 05^0C 28′ North and 07^0C 32′East and lies at an altitude of 122m above sea level. This area is situated within the tropical rainforest zone of West Africa which is characterized by long duration of rainfall (April - October) and short period of dry season (November-March). Average rainfall is 2169.8mm in 148 – 155 rain days. Average ambient temperature is 26^0C with a range 22^0C and 30^0C. Its relative humidity ranges from 50 to 90%. These meterological data were obtained from the meteorological station at the National Root Crops Research Institute, Umudike, Abia State.

Management of the based population and production of F_1 birds

A total of 78 one day-old local turkeys of three phenotypic classes based on plumage colour (black, white and spotted) were obtained from a commercial hatchery. The poults comprised of 26 black, 23 white and 29 white phenotypes. They were reared to generate F_1 progeny with clear plumage colour differentiation for the study. At time of breeding, 2 Toms and 12 hens of black, 2 Toms and 12 hens of white and 3 Toms and 18 hens of spotted were used for mating. Random mating was used for the mating scheme within each identified group by selecting sexually active males for the females in the ratio of 1:6 for egg production. Eggs produced by the base population turkeys were collected on a daily basis, identified appropriately with markers and set in the incubator on weekly basis. Total number of eggs laid was 356 comprising 128, 114 and 114 for Black, White and Spotted phenotypes, respectively and stored for less than 7 days in crates with large end up. The laying period was between 25 and 30 weeks of age. The incubator was Cabinets incubator type with relative humidity of 80%, temperature

of 55^{0C}, proper ventilation and turning suitable for hatchable eggs. The eggs were hatched weekly in batches. The numbers of progeny (F_1) poults produced were 86, 72 and 74 for black, white and spotted, respectively. The poults were properly identified on hatching. Distribution and number of poults hatched per phenotypic class is shown in Table 1.

Table 1: Distribution of local turkey poults hatched per phenotypic class

		Hatch					
Mating	**Phenotypic class**	**1**	**2**	**3**	**4**	**5**	**Class total**
Black x Black	Black	3	11	10	36	26	**86**
White x White	White	2	6	6	28	30	**72**
Spotted x Spotted	Spotted	2	7	8	26	31	**74**
Total hatch		**7**	**24**	**24**	**90**	**87**	**232**

They were subjected to brooding in a deep litter system for proper physical development for 6 weeks after which they were transferred to small compartments. The birds were kept in an open sided poultry house. Dry wood shaving was used as litter material. The experimental house was divided into three, one for each genetic group namely black, white and spotted. Routine management operations such as washing of the water and feed troughs were carried out on daily basis. The birds were given routine vaccination as shown in Table 2

Table 2: Vaccination schedule of the experimental birds

Disease/Vaccination	Age	Method/route of administration
NCDV	Day-old	i/o
Gumboro	7 days	Oral
Lasota	14 days	Oral
Gumboro	21 days	Oral
Fowl pox	56 days	Wing-web
NCDV	9 weeks	Oral
NCDV	16 weeks	Oral

Source: Omole *et al*. (2006)

Prophylactic antibiotics and anticoccidial drugs were administered to the birds periodically via drinking water. The birds were also dewormed and andacaricide sprayed to check worms and ectoparasites. The respective hatches were brooded separately on floor pens. The brooding period lasted 6 weeks. From brooding through rearing, maximum comfort for the poults was ensured. Feed was provided in adequate quantity to the poults twice a day (8.30am and 2.30pm) and drinking water was given *ad libitum*. Poults (0-6 weeks) were fed *ad libitum* with starter mash containing 28% crude protein and 2800kcal ME/kg. Growing turkeys (7-24 weeks) were fed growers mash (20% crude protein and 3000 kcal ME/kg). Laying hens (25-30 weeks) were on growers mash until 5% egg production was attained. During egg production hens were fed with 18% crude protein and 3200kcal ME/kg.

Rearing was between 7 and 24 weeks. Sexing was done at 16 weeks of age by observing the growth of wattle on the males only.

Parameters measured

Quantitative traits measured were: Fertility (%), Hatchability of fertile eggs (%), Hatchability of eggs set (%), Peeped (%)

and Dead in shell (%).

Fertility (%):

$$\frac{\text{Number of fertile eggs}}{\text{Number of eggs set}} \times 100$$

Hatchability of fertile eggs (%):

$$\frac{\text{Number of poults hatched}}{\text{Number of fertile eggs}} \times 100$$

Hatchability of eggs set (%):

$$\frac{\text{Number of poults hatched}}{\text{Number of eggs set}} \times 100$$

Peeped (%):

$$\frac{\text{Number peeped}}{\text{Number of poults hatched}} \times 100$$

Dead in shell (%):

$$\frac{\text{Number of dead in shell}}{\text{Number of poults hatched}} \times 100$$

Experimental design

The experiment was designed as a randomized complete block (RCBD) with phenotypic class as factor of interest and hatch as block. The statistical model is given in Expression (1)

$$\mathbf{Y_{ijk} = \mu + H_i + P_j + e_{ijk}} \quad \ldots (1)$$

Where

Y_{ijk} = k^{th} observation in the i^{th} block and in the j^{th} phenotypic class

μ = Overall mean

H_i = effect of the i^{th} hatch (Block) (i = 1,…,5)

P_j = effect of j^{th} phenotypic class (j=1, …, 3)

e_{ijk} = Random error, assumed to be independently, identically and normally distributed with zero mean and constant variance [iind $(0,\sigma^2)$].

Statistical analysis

Data obtained were statistically analyzed with Statistical Procedure for Social Sciences (SPSS), 2011 version 16. All the parameters were determined in percentages which were subjected to arcsine transformation to satisfy the assumption of normal distribution. Duncan's Multiple Range Test (Duncan, 1955) was used to separate significant means.

Results and discussion

Fertility and hatchability parameters of three local turkey varieties (base population) are presented in Table 4.

Table 4: Fertility and hatchability values of local turkey

	Phenotypic class		
Parameters	**Black**	**White**	**Spotted**
Fertility (%)	77.56 [b]	62.19 [c]	80.51 [a]
	(6.28)	(13.90)	(5.91)
Hatchability of fertile eggs (%)	74.91 [a]	72.45 [b]	69.32 [c]
	(5.60)	(6.68)	(6.54)
Hatchability of eggs set (%)	62.20 [a]	49.77 [b]	56.90 [ab]
	(8.19)	(11.37)	(8.19)
Peeped (%)	4.37 [b]	0.00 [c]	11.34 [a]
	(2.18)	(0.00)	(9.70)
Dead-in-shell (%)	28.66 [b]	44.09 [a]	28.59 [b]
	(11.09)	(17.41)	(7.77)

[abc:] Means in the same row with different superscripts are significantly different (p<0.05).
**S.E.M in parentheses*

There was significant difference (p<0.05) in the fertility (%) of the phenotypic classes, with spotted turkeys having the highest value. This result is similar to the values (70-80%) reported by Hawes *et al.* (2007) and fall within the range (70-83%) for local/heritage turkeys (Wischart *et al*., 2001). This was similar to reports that spotted turkeys have higher ability to reproduce (Modupe, 2013). The black turkey was significantly (p<0.05) highest in hatchability of fertile eggs and hatchability

of eggs set when compared with the white and spotted varieties. The differences may be due to environmental factors and genetic influence. Peeped percent was significantly ($p<0.05$) lowest in the white turkeys. This indicates that poult peeped in the white turkeys rather some died in the shell.

There was significant difference ($p<0.05$) in the dead in shell percent of the phenotypic classes, with black and spotted turkeys having the lower values to compare with the white turkeys. A number of factors including egg age (Tarongoy *et al.,* 1990), storage condition (Brah and Sandhu, 1989), age of flock (Buhr, 1995), mating system (Gebhardt-Henrich and Mark, 1991), incubation relative humidity and eggs turning angle (Permsak, 1996) have been shown to influence the hatchability of poultry eggs. Improved management of eggs during incubation may therefore help to increase the hatchability of eggs.

Conclusion

This study has revealed that Spotted and black phenotypes exhibited greater performance in fertility traits including hatchability of fertile eggs (%) among the three phenotypic groups.

In view of the results obtained in this study, it is recommended that the spotted phenotype should be selected by breeders to achieve improved fertility, hatchability and production. Also management of eggs during incubation should be improved to increase the hatchability of eggs.

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