EFFECT OF GENOTYPE ON EGG QUALITY CHARACTERISTICS OF GUINEA FOWL (*NUMIDA MELEAGRIS GALEATA*) IN A HUMID TROPICAL ENVIRONMENT

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ABSTRACT
This study was conducted to investigate the effect of genotype on egg quality traits of guinea fowl. The genotypes were Pearl x Pearl (PL x PL), Black x Black (BL x BL) and Pearl x Black (PL x BL). A total of 272 eggs were used for the study. A sample of 80 eggs comprising 35 from PL x PL, 32 from BL x BL and 13 from PL x BL were randomly selected and used to evaluate the shell and internal egg quality characteristics. The external and shell quality parameters measured were egg weight (EWGT), egg length (ELGT), egg width (EWDT), egg shape index (ESPI), shell weight (SWGT), and shell thickness (STKN) while the internal traits were egg mass (EMAS), yolk weight (YWGT), yolk diameter (YDM), yolk height (YHGT), yolk index (YIDX), albumen weight (AWGT), albumen height (AHGT), albumen diameter (ADM), albumen index (AIDX). Genotype significantly ($P<0.05$) influenced some of the external and internal traits. ELGT and ESPI of PL x BL genotype were statistically superior to those of the other genotypes. The values were 48.53 ± 0.47 mm, 46.67 ± 0.28 mm and 46.16 ± 0.28 mm (ELGT), 76.70 ± 0.52 %, 78.93 ± 0.40 % and 77.45 ± 0.43 % (ESPI) for PL x BL, PL x PL and BL x BL, respectively. Generally, PL x BL eggs had significantly ($P<0.05$) better egg quality both in terms of external and internal traits compared to PL x PL and BL x BL eggs. However, PL x BL eggs compared favourably ($P>0.05$) with those of BL x BL in egg mass (g) and yolk index (%) and PL x PL in albumen index (%).The result of this study suggests that these traits could be improved through crossbreeding.

Keywords: Genotype, Egg quality, Traits, Crossbreeding, Guinea fowl,

INTRODUCTION
Eggs are one of the principal sources of income in the poultry industry. The profit margin accruable to the farmer is influenced by the production capacity of the genotype reared. The guinea fowl is gradually finding its share in the world poultry market, including Nigeria, because of increasing demand for speciality poultry products such as table eggs and the changing demographics of the population (Nahashon *et al*., 2006). Embury (1998) reported that the guinea fowl has a worldwide acceptability as a table bird due to its high meat to bone ratio, game type flavour and attractive plumage.

In Africa, the guinea fowl's native home, where it has distinct popularity among smallholder farmers (Nwagu and Alawa, 1995), it represents a potential source of animal protein that is yet to be exploited. Ayorinde (2004) recorded that the guinea fowl ranks second to the domestic fowl in the production of meat and eggs in Nigeria. However, the problem with guinea fowl production

in this region has remained the low productivity of stocks arising from poor genotypes farmed by producers with concomitant low profit margins. Although efforts has been underway to promote guinea fowl as a specialty and as an alternative to chicken eggs, very few information concerning egg quality traits of guinea fowl is found in literature. This is in contrast to the domestic chicken where extensive research and information is very much available.

Tumova *et al*. (2009) reported that egg quality is influenced by many internal and external factors one of which is genotype. In corroboration, Oke (2004) stated that egg quality traits are determined by a very large number of genes and could be improved by selective breeding.
Thus, the quality of breeding eggs has an overall significance for the continuity of the flocks and for an economic return. Moreover, the significance of the egg as a protein source for the nourishment of humans has led consumers to demand for some standards. Egg quality has been defined by Stadelman (1977) as the characteristics of an egg that affect its acceptability to consumers.

The need therefore for provision of more information on major egg quality characteristics that will aid in genetic improvement of guinea fowl for increased productivity is paramount. Moreover, evaluation of the external and internal quality of guinea fowl eggs is also important because of consumer's preferences for good quality eggs. The objective of this study was to evaluate the influence of different genotypes of guinea fowl on egg quality characteristics and to recommend the most suited genotype for egg production in terms of egg quality indices in a humid tropical environment of Nigeria.

MATERIALS AND METHODS

This study was carried out at the Poultry Unit of the Teaching and Research farm, Michael Okpara University of Agriculture, Umudike. A population of 45 locally adapted adult guinea fowls which comprised of 36 females and 9 males were used to generate the eggs used for the study. The birds were randomly allocated to deep litter pens according to genotype (treatment) and each treatment had 3 replicates with 5 birds per replicate and a mating ratio of 1guinea cock: 4 guinea hens. Three genotypes namely Pearl x Pearl (PL x PL), Black x Black (BL x BL) and Pearl x Black (PL x BL) were considered. The birds were fed layers mash containing 18% CP and 10.36 MJ ME/kg *ad libitum* throughout the experimental period. Fresh clean water was supplied regularly to the birds. The total number of eggs studied was 272 eggs (Table 1). A sample of 80 eggs comprising 35 from PL x PL, 32 from BL x BL and 13 from PL x BL were used to evaluate the internal and shell egg quality traits. EWGT, SWGT, YWGT AND AWGT were measured with an electronic sensitive balance to the nearest 0.01 g. YIDX, AIDX and ESPI were calculated as percentages with the following formulae (Kul and Seker, 2004).

YIDX (%) = (Yolk height/Yolk diameter) x 100

AIDX (%) = [Albumen height /(Albumen length + Albumen width)]/2 x 100

ESPI (%) = Egg width/Egg height x 100

ELGT, EWDT, STKN, EMAS, YDM, YHGT, AHGT and ADM were measured using vernier calliper. The design of the experiment was Completely Randomized design (CRD) with genotype as the factor of interest. Data collected were subjected to analysis of variance using SAS (2001) analytical package and significant means were separated using Duncan's New Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

The results of the external egg quality traits for the three genotypes are presented in Table 2. Among these traits, significant differences ($P<0.05$) were observed only for ELGT and ESPI in PL x BL genotype. Both traits were statistically superior to those of the other genotypes (PL x PL and BL x BL). The values were 48.53 ± 0.47 mm, 46.67 ± 0.28 mm and 46.16 ± 0.28 mm (ELGT), 76.70 ± 0.52 %, 78.93 ± 0.40 % and 77.45 ± 0.43 % (ESPI) for PL x BL, PL x PL and BL x BL, respectively. These values are similar to the reports of Akanni *et al*. (2010) and Obike *et al*. (2011). Akanni *et al*. (2010) gave a range of 75 – 78 % ESPI for pure and crossbred laying chickens. On the contrary, Nowaczewski *et al*. (2008) reported a lower value of 73.7 % and 74.7 % for French and Polish strains of guinea fowl in the temperate region. Although not significantly different ($P>0.05$) among the genotypes, EWGT, EWDT, STKN and SWGT of PL x BL were also numerically higher compared to those of PL x PL and BL x BL. The means ± SE of internal egg quality traits of the genotypes are given in Table 3. Significant differences ($P<0.05$) were noted among the genotypes for all the traits, except for YWGT and YHGT. The result indicated that the internal egg quality characteristics of PL x BL eggs were statistically better in comparison with those of PL x PL and BL x BL eggs. However, PL x BL eggs compared favourably with those of BL x BL in EMS (g) and YIDX (%) and PL x PL in AIDX (%).

Generally, the values recorded in this study are consistent with the reports of others (Fayeye *et al*., 2005; Dudusola, 2010; Nwagu *et al*., 2010) for guinea fowl and chicken eggs. The significant ($P < 0.05$) effect of genotype on the egg quality traits as observed in this work have also been reported by some others in the domestic chicken (Oluwumi and Ogunlade, 2009; Akanni *et al*., 2010). The authors noted significant breed effects for egg quality traits in exotic chickens. Islam *et al*. (2001) also reported significant differences in indigenous naked neck and full-feathered chickens. The higher egg quality characteristics of the crossbred genotype may be due to heterosis or hybrid vigour. Agaviezor *et al*. (2011) attributed the higher egg weight values of crossbred chickens when compared to those of the local ones to hybrid vigour. Therefore, the implication of our results is that these egg quality traits of the indigenous guinea fowl could be improved through crossbreeding by exploiting the advantages of hybrid vigour.

CONCLUSION

Genotype significantly influenced both the external and internal egg quality characteristics of the layer guinea fowls. Crossbred eggs showed significantly better quality traits compared to the eggs of the purebreds. This may be attributed to heterosis, suggesting that egg quality traits of guinea fowl could be improved by crossbreeding.

Table 1: Mating scheme and number of eggs produced by the genotypes

Mating type	Number of hens	Number of cocks	Number of eggs laid
PL x PL	12	3	128
BL x BL	12	3	97
PL x BL	12	3	47
Total	36	9	272

PL x PL = Pearl x Pearl, BL x BL = Black x Black, PL x BL = Pearl x Black

Table 2: Means (±SE) of external egg quality traits of the different guinea fowl genotypes

	Genotype		
Trait	PL x PL	BL x BL	PL x BL
Egg weight (g)	37.50 ± 0.32	38.01 ± 0.01	38.09 ± 0.46
Egg length (mm)	45.67 ± 0.28^{c}	46.16 ± 0.27^{b}	48.53 ± 0.47^{a}
Egg width (mm)	36.56 ± 0.12	36.63 ± 0.18	36.73 ± 0.17
Shell thickness (mm)	0.45 ± 0.04	0.40 ± 0.04	0.45 ± 0.07
Shell weight (g)	7.22 ± 0.28	7.09 ± 0.32	7.52 ± 0.35
Shape index (%)	78.93 ± 0.40^{a}	77.45 ± 0.43^{a}	76.70 ± 0.52^{b}

^{abc}Means in the same column with different superscripts are significantly different (P < 0.05). PL x PL = Pearl x Pearl, BL x BL = Black x Black, PL x BL = Pearl x Black

Table 3: Means (±SE) of internal egg quality traits of the different guinea fowl genotypes

	Genotype		
Trait	PL x PL	BL x BL	PL x BL
Egg mass (g)	29.34 ± 0.97^{b}	30.03 ± 0.44^{ab}	32.16 ± 0.65^{a}
Yolk weight (g)	12.52 ± 0.27	12.28 ± 0.22	12.81 ± 0.47
Yolk diameter (mm)	34.93 ± 0.48^{b}	35.48 ± 0.53^{b}	37.45 ± 0.56^{a}
Yolk height (mm)	13.09 ± 0.39	14.73 ± 0.99	14.38 ± 0.46
Yolk index (%)	35.69 ± 1.35^{b}	37.04 ± 1.74^{ab}	41.21 ± 1.36^{a}
Albumen weight (g)	17.20 ± 0.20^{b}	18.00 ± 0.44^{b}	20.07 ± 0.44^{a}
Albumen diameter (mm)	57.49 ± 1.79^{c}	62.95 ± 1.05^{b}	67.01 ± 1.24^{a}
Albumen height (mm)	7.25 ± 0.20	7.62 ± 0.30^{ab}	8.18 ± 0.35^{a}
Albumen index (%)	12.38 ± 1.01^{ab}	10.50 ± 0.63^{b}	14.21 ± 1.36^{a}

^{abc} Means in the same column with different superscripts are significantly different (P < 0.05). PL x PL = Pearl x Pearl, BL x BL = Black x Black, PL x BL = Pearl x Black

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