

EGG HATCHABILITY AND GROWTH PERFORMANCE OF SUSSEX AND ORPINGTON CHICKEN IN HUMID GUINEA SAVANNA OF NIGERIA

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Abstract

Sussex and Orpington are among the recent exotic strains of chicken that were imported into West Africa. There is the need to evaluate the adaptability of these chicken strains to different tropical production environments. The present study was carried out to evaluate the hatchability of eggs and growth performance of Sussex and Orpington chickens in a humid guinea savannah climate of Nigeria. Data was collected on fertility, hatchability and weekly body weight from hatch to 17 weeks of age. Mean percent fertility, percent hatchability of fertile eggs and percent hatchability of total eggs were 66.47%, 96.52% and 64.16%, respectively. Fertility and hatchability of total egg set were higher in eggs collected from Orpington than Sussex chicken. Orpington chicks were significantly ($p < 0.05$) higher in weekly body weights than Sussex chicks at weeks 1, 8, 9, 11, 13 and 17 of age. Male grower chicks were significantly ($p < 0.05$) higher in body weight than female grower chicks at weeks 11, 13, 15 and 17. The interaction between breed and sex on weekly body weight was significant ($p < 0.05$). It was concluded that the two breeds showed good growth performance under the humid guinea savannah climate of Nigeria. However, Orpington chicken is preferred on the basis of its superior weekly body weight.

Key words: Adaptation, body weight, breed x sex interaction, fertility, hatchability, sussex.

Introduction

Genetic improvement in exotic chicken has been achieved primarily through selection for growth rate, feed conversion efficiency and degree of muscling. Havenstein *et al.* (1994) stated that 90% of the phenotypic changes in poultry have come from genetic progress. Indigenous chickens in Nigeria are valuable resources for genetic improvement programme through selection. However, previous efforts aimed at genetic progress in indigenous chicken have been limited by the huge funding needed for a long term selection programme. An alternative to genetic improvement through selection is crossbreeding aimed at combining advantageous dominant alleles in both local and exotic chickens. The third approach is through the introduction of new breeds or strains. However, the harsh tropical environment which is characterised by high temperature, disease and shortage of feed (Islam and Nishibori, 2009) possess significant challenge to the survival of exotic chickens. Permin (2008) reported that previous schemes on introduction of new animals failed to work due to problems of adaptation of the introduced breed to hot climate, low feeding and extensive management. Barker (2009) defined adaptation as the ability of an

animal to survive and reproduce within a defined environment or the degree to which the introduced animal can remain or become adapted to a wide range of environment by physiological or genetic means. Mirkena *et al.* (2010) noted that the development of adapted poultry species can quickly bridge the required protein gap in developing countries.

Sussex and Orpington are among the recent exotic strains of chicken that were imported into West Africa. The two breeds are good producers of meat and eggs in their native country. However, there is the need to evaluate the adaptability of these chicken strains to the tropical production environment. Fertility in poultry refers to the percentage of incubated eggs that are fertile while hatchability is the percentage of fertile eggs that hatch (Ahmedin and Mangistu, 2016). Kwacskiet *et al.* (2012) stated that Hatchability results are the most important indicators of the efficiency of breeding methods. Kingori (2011) reported that fertility and hatchability are interrelated traits that vary among breeds, varieties or individuals in a breed. The report of Farooq *et al.* (2001) suggests that hatchability of eggs is reduced with reduced fertility. The present study was carried out to

evaluate the hatchability of eggs and growth performance of Sussex and Orpington chickens in a humid guinea savannah climate of Nigeria.

Materials and Methods

Experimental site:

The study was carried out at Ilorin, Kwara state. Ilorin is located on latitude 8.35°E and longitude 4.35°N. It has a humid guinea savannah climate characterized by both wet and dry season with a mean annual temperature of between 1150mm.

Experimental Birds and their Management:

A total of 173 fertile eggs of Sussex and Orpington chickens were set in a commercial incubator for 21 days. Egg turning, candling and other egg handling operation were as applicable to standard hatchery. Hatched chicks were identified with wing tags. Chicks were raised in floored pen until 17 weeks of age. Birds were fed *ad-lib* for the first 7 weeks on commercial chick mash. On the 8th week the diet was replaced with a commercial grower mash which was fed to them until 18 weeks of age. The grower mash used contained 16.00 % Crude Protein, 5.00% fat and Oil, 7% Crude fibre, 1.00% calcium, 0.45% Phosphorus, 0.75% Lysine, 0.36% Methionine, 0.30% Vitamins and 2450 Kcal/kg Metabolizable Energy. Routine medication, sanitation, and water supply were as described by NRC (1994). Vaccines were administered at the 2nd, 3rd and 7th week of age against Gumboro disease, Newcastle disease and bronchitis, respectively. Routine use of multivitamins was also done. All prophylactic vaccines and multivitamin were administered orally through the drinking water.

Data collection:

Data was collected on fertility, hatchability and weekly body weight from hatch to 17 weeks of age.

Percentage Fertility =

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

Hatchability of fertile egg =

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

Hatchability of egg set =

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

Body weight of chicks was measured in gram

using manual sensitive scale and top loading

balance (20kg capacity).

Statistical analysis

Microsoft excel computer software program was used to record all the data before preliminary statistical analysis were done. All the data collected were subjected to Analysis of Variance using Statistical Analysis Software (SAS, 1999).

Significant means were separated using the same SAS program. The General Linear Model employed for the study was of the form:

$$Y_{ijk} = \mu + G_i + S_j + GS_{ij} + e_{ijk}$$

Where:

Y = performance of kth individual belonging to jth sex and ith genotype

μ = general mean of the parameter

G_i = fixed effect of the genotype (i = 1 - 2)

S_j = fixed effect of the sex (j = 1 - 2)

GS_{ij} = Interaction between G and S

e_{ijk} = residual error

Results

The results on fertility and hatchability of eggs are presented in Table 1. Mean percent fertility, percent hatchability of fertile eggs and percent hatchability of total eggs were 66.47%, 96.52% and 64.16%, respectively. Fertility and hatchability of total egg set were higher in eggs collected from Orpington than Sussex chicken.

Table 1: Fertility and Hatchability of Sussex and Orpington eggs

	NES	NFE	NHE	%F	%HFE	%HTE
Sussex	125	75	73	60.00	97.33	58.40
Orpington	48	40	38	87.50	95.00	79.16
Total	173	115	111	66.47	96.52	64.16

NES, NFE, NHE, %F, %HFE, %HTE represent Number of Eggs Set, Number of Fertile Eggs, Number of Hatched Eggs, Percent Fertility, Percent Hatchability of Fertile Eggs, Percent Hatchability of Total Eggs, respectively

The effects of genotype and sex on hatch and weekly body weights (1-8 weeks) of chicks are presented in Table 2. Orpington chicks were generally higher in weekly body weights than Sussex chicks. The difference between Orpington

and Sussex chicks in weekly body weight was significant ($p < 0.05$) at weeks 1 and 8. Although male chicks were nominally heavier than female chicks from 5 to 8 weeks of age, the differences were not significant ($p > 0.05$).

Table 2: Effects of genotype and sex on weekly body weights of Sussex and Orpington chicks

Age	Sussex	Orpington	Male	Female
Day-old	37.72 ± 0.67 (54)	36.45 ± 0.88 (22)	37.83 ± 0.73 (42)	36.76 ± 0.81 (34)
Wk1	58.3 ± 1.24 (54) ^a	72.73 ± 2.39 (22) ^b	60.33 ± 1.83 (42)	65.12 ± 1.91 (34)
Wk2	119.11 ± 3.18 (54)	121.91 ± 4.07 (22)	117.05 ± 3.88 (42)	123.47 ± 2.97 (34)
Wk3	8.07 ± 5.43 (54)	216.14 ± 37.21 (22)	174.45 ± 6.51 (42)	207.18 ± 24.14 (34)
Wk4	259.06 ± 6.92 (54)	244.14 ± 7.01 (22)	254.45 ± 8.42 (42)	255.09 ± 6.05 (34)
Wk5	331 ± 8.94 (54)	331.82 ± 9.69 (22)	336.33 ± 10.54 (42)	324.94 ± 8.34 (34)
Wk6	392.69 ± 9.78 (54)	402.45 ± 12.45 (22)	403 ± 11.58 (42)	386.26 ± 9.93 (34)
Wk7	453.93 ± 10.68 (54)	485.41 ± 17.55 (22)	477.31 ± 12.97 (42)	445.41 ± 12.5 (34)
Wk8	453.93 ± 10.68 (54) ^a	538.23 ± 23.9 (22) ^b	554.43 ± 16.02 (42)	511.79 ± 14.86 (34)

Group mean, Standard error and number count of sample ($x \pm \text{SEM}$) were as shown. Wk = week. Number of birds in parenthesis. ^{a,b} represents significant difference between means for the genotypes or sex at $p < 0.05$

Orpington grower chicks were significantly ($p < 0.05$) higher in body weight than Sussex grower chicks at weeks 9, 11, 13 and 17 (Table 3).

Male grower chicks were significantly ($p < 0.05$) higher in body weight than female grower chicks at weeks 11, 13, 15 and 17 (Table 3).

Table 3: Effects of genotype and sex on weekly body weights of Sussex and Orpington grower chicks

Age	Sussex Chicken	Orpington Chicken	Male Chicken	Female Chicken	p-value
Wk9	579.2 ± 15.45 (54) ^a	685.91 ± 29.95 (22) ^b	636.93 ± 20.74 (42)	576.94 ± 20.4 (34)	0.005
Wk11	777.74 ± 19 (54) ^a	913.82 ± 34.26 (22) ^b	865.24 ± 24.51 (42) ^b	757.71 ± 23.38 (34) ^a	0.001
Wk13	903.98 ± 21.45 (54) ^a	1043.86 ± 32 (22) ^b	1005.12 ± 25.18 (42) ^b	869.56 ± 24.24 (34) ^a	0.002
Wk15	1023.89 ± 23.2 (54)	1203.41 ± 30.84 (22)	1152.86 ± 26.29 (42) ^b	980.74 ± 25.64 (34) ^a	0.005
Wk17	1350.65 ± 168.2 (54) ^a	1367.27 ± 34.56 (22) ^b	1319.88 ± 29.43 (42) ^a	1399.41 ± 266.88 (34) ^b	0.006

Group mean, Standard error and number count of sample ($x \pm \text{SEM}$) were as shown, Wk = week, ^{a,b} represents significant difference between means for the genotypes or sex at $p < 0.05$

Results on the interaction between genotype and sex on Body weight of Sussex and Orpington chicks are shown in Tables 4 and 5. The interaction between the two fixed effects was significant ($p < 0.05$) at week 3 where female Orpington was significantly ($p < 0.05$) higher than

female Sussex but male Orpington was not significantly ($p > 0.05$) different from female Sussex in body weight. There were also significant ($p < 0.05$) interactions between genotype and sex at weeks 9, 11, 13 and 15.

Table 4: Interaction between genotype and sex on Body weight of Sussex and Orpington chicks

Age	Male Sussex	Female Sussex	Male Orpington	Female Orpington	p-value
Day1	38.1 ± 0.96 (30)	37.25 ± 0.94 (24)	37.17 ± 0.92 (12)	35.6 ± 1.62 (10)	0.001
Wk1	56.2 ± 1.7 (30) ^b	60.92 ± 1.68 (24) ^b	70.67 ± 3.3 (12) ^a	75.2 ± 3.49 (10) ^a	0.000
Wk2	117.17 ± 5.13 (30)	121.54 ± 3.23 (24)	116.75 ± 4.84 (12)	128.1 ± 6.54 (10)	0.005
Wk3	173.77 ± 8.75 (30) ^b	183.46 ± 5.45 (24) ^b	176.17 ± 6.92 (12) ^b	264.1 ± 81.06 (10) ^a	0.034
Wk4	261.7 ± 11.17 (30)	255.75 ± 7.13 (24)	236.33 ± 7.83 (12)	253.5 ± 12.02 (10)	0.013
Wk5	336.93 ± 14.03 (30)	323.58 ± 9.97 (24)	334.83 ± 12.33 (12)	328.2 ± 16.01 (10)	0.001
Wk6	402.03 ± 15.17 (30)	381 ± 11.07 (24)	405.42 ± 15.21 (12)	398.9 ± 21.3 (10)	0.002
Wk7	473.23 ± 16.21 (30)	429.79 ± 11.47 (24)	487.5 ± 21.19 (12)	482.9 ± 30.34 (10)	0.013
Wk8	557.73 ± 19.3 (30)	504.75 ± 13.32 (24)	546.17 ± 29.72 (12)	528.7 ± 40.23 (10)	0.007

^{a,b} means with different superscript within breeds and sex are significantly different ($p < 0.05$)

Group mean, Standard error and number count of sample ($x \pm \text{SEM}$) were as shown. wk = week.

Table 5: Interaction between genotype and sex on Body weight of Sussex and Orpington grower chicks

Age	Male Sussex	Female Sussex	Male Orpington	Female Orpington	p-value
Wk9	611.03 ^{ab} ± 23.61 (30)	539.42 ^b ± 15.33 (24)	701.67 ^a ± 37.45 (12)	667 ^{ab} ± 49.73 (10)	0.005
Wk11	828.83 ^b ± 26.95 (30)	713.88 ^c ± 20.21 (24)	956.25 ^a ± 44.68 (12)	862.9 ^{ab} ± 50.69 (10)	0.001
Wk13	968 ^b ± 30.3 (30)	823.96 ^c ± 20.94 (24)	1097.92 ^a ± 33.55 (12)	979 ^b ± 52.44 (10)	0.002
Wk15	1106.67 ^b ± 31.57 (30)	920.42 ^c ± 19.56 (24)	1268.33 ^a ± 27.35 (12)	1125.5 ^b ± 50.48 (10)	0.005
Wk17	1268.5 ± 35.2 (30)	1453.33 ± 379.35 (24)	1448.33 ± 32.19 (12)	1106.67 ± 31.57 (30)	0.006

^{a,b} means with different superscript within breeds and sex are significantly different ($p < 0.05$)

Group mean, Standard error and number count of sample ($x \pm \text{SEM}$) were as shown. wk = week.

Discussion

The fertility of eggs and hatchability of total eggs set in the present study were lower than the values of 92.40-90.90% and 90.89-92.43%, reported for fertility and hatchability of total egg set (respectively) in Cobb 500 by Ramaphala and Mbajiorgu (2013). However, the fertility and hatchability of eggs obtained in this study were within the range reported for chickens in Africa and Asia (Farooq *et al.*, 2001, Oleforuh-Okoleh, 2016). Gryzińska *et al.* (2005) obtained fertility rate of (81%) for eggs obtained from Sussex chickens that were kept as Polish conservation flock. The difference in hatchability results between Sussex and Orpington in this study agrees with previous report on the effect of genotype on hatchability of eggs. For instance, Farooq *et al.* (2001) reported 88.57% hatchability in Fayumi chickens, while values obtained for Rhode Island Red and Desi chicken were 80.77% and 60.00%, respectively. In another report, Oleforuh-Okoleh (2016) reported hatchability of 87.73 and 88.27 percent for Black Olympia and the Nigerian local chicken, respectively. The observed variation between genotypes is a function of the genetic constitution of the strains of birds. In addition, such differences are expected for eggs handled under different incubation environment, and from interaction between genotype and incubation environment (Oleforuh-Okoleh, 2016).

The mean hatch weights of Sussex and Orpington chicks in the present study were higher than 27-28g reported earlier by Fayeye *et al.* (2005) for Nigerian Fulani ecotype chicken. Malago and Baitilwake (2009) reported a higher mean hatch weight for Rhode Island Red than local Tanzanian and crossbred chickens. The higher growth performance of exotic chickens in these previous studies suggests that introduction of exotic breeds could be a veritable approach to boosting the contribution of poultry species like chicken to animal protein supply in Africa. The higher growth performance of the exotic birds could be attributed to their ability to produce bigger eggs. Abiola *et al.* (2008) stated that positive correlation exists between egg size and chick hatching weight of Anak broiler chicken. An earlier report by Farooq *et al.*, (2001) also showed positive correlation between egg weight and hatching chick weight in Rhode Island Red and scavenging Desi Fayoumi chicken in Pakistan. The higher weekly body weight of Orpington chicks

suggests its genetic superiority over Sussex chicks. An earlier work in South West Nigeria by Amusan *et al.* (2013) showed that genotype has significant effects on the growth performance, feed intake and feed efficiency of the progenies resulting from pure, straight and reciprocal cross of Giriraja and Alpha chickens. Barua *et al.* (1992) reported that Rhode Island Red has the highest body weight gain (1494.39g), followed by White Leghorn (1392.57g), Rhode Island Red x Naked Neck (1268.9g) and White Leghorn x Naked Neck (1266.73g). had body weight of 945g and 905 at 16 weeks of age, respectively. The higher body weight of Orpington chicks at week 1 and week 17 showed that early post-hatch body weight is a good pointer to the final body weight in chicken. This conclusion agrees with the submission of Abiola *et al.* (2008) who reported that Anak broiler chicks with the highest hatch weight also had the highest final body weight.

The results obtained in the study supports earlier reports that avian species like chickens, showed marked sexual dimorphism in body weight, with males being substantially heavier than females (Fayeye *et al.*, 2005, Tercic, and Holcman, 2008, Bekele *et al.* 2010, Fayeye and Ogundere, 2017). Kgwatalala *et al.* (2012) reported significantly higher body weights in males than females of the naked-neck and normal strains of indigenous Tswana chicken from 14 weeks to 20 weeks of age. Sexual dimorphism in body weight could be due to the effective male growth hormones compared with female hormones (Singh *et al.*, 1982). Reece *et al.* (1984) reported that male broilers were superior to female in feed utilisation by 3.3%. An earlier report by Ricklefs (1985) suggested that differences in physiological ages between males and females at the same chronological age may be responsible for sexual dimorphism in body weight.

Conclusion

It was concluded that both Orpington and Sussex breeds showed good growth performance under the humid guinea savannah climate of Nigeria. However, Orpington chicken is preferred on the basis of its superior weekly body weight.

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