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Breed and egg weight influence on hatchability and fertility in Sasso, Shika brown and their crosses

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Abstract

The effect of breed and egg weight on hatchability and fertility in Sasso, Shika brown and their crosses was studied. A total of 1,107 eggs comprising 509 Sasso eggs (46 light, 285 medium, 178 heavy), 392 Shika brown egg (141 light, 97 medium, 154 heavy) and 205 Sasso x Shika brown cross (19 light, 145 medium, 42 heavy) were used for this study. The eggs were collected, weighed and sent to the hatchery for incubation and hatching. Data on number of fertile eggs, number of fertile eggs hatched, fertile eggs not hatched, eggs not fertile, chicks dead in shell, deformed chicks and total number of eggs were obtained. The results revealed a significant ($p<0.05$) effect of breed on the number of fertile eggs, fertile number of eggs hatched, fertile but not hatched eggs, eggs not fertile, chicks dead in shell, deformed chicks and total number of eggs. Sasso and Shika Brown had more number of fertile eggs as compared to Sasso x Shika Brown cross. For fertile number of eggs hatched, Sasso had the highest mean number of fertile eggs hatched (19.55±0.30). Also, considering fertile but not hatched eggs, the highest value (8.77±0.30) was seen in Shika brown. Sasso had the highest number of eggs not fertile (35.55±0.36). The number (0.66±0.11) of deformed chicks was highest in Shika brown. Total number of eggs was highest in Sasso (56.55±0.36). There was also a significant ($p<0.05$) effect of egg weight on the number of fertile eggs, fertile number of eggs hatched, fertile but not hatched eggs, eggs not fertile, deformed chickens and total number of eggs. Shika brown had the highest number of fertile eggs and the least was observed in Sasso. Fertile numbers of eggs hatched were highest among medium weight (28.55±0.30). For fertile but not hatched eggs, the light weight eggs had the highest value of 4.88. For eggs not fertile, the highest significant value was observed in heavy weight eggs (27.88±0.30). Chicks dead in shell were not significantly affected by egg weight. From the interactive effect of breed and egg weight on hatchability and fertility, the highest value of fertile eggs was observed in medium weight eggs of Sasso and the least in heavy weight of Sasso x Shika brown crosses. The highest value of fertile eggs hatched was observed in medium weight eggs of Sasso (41.00±0.36). Furthermore, the highest number of eggs not fertile was observed in medium weight eggs of Sasso (50.00±0.63). Deformed chicks were only observed in light weight eggs of Shika Brown (2.00±0.19) and heavy weight eggs of Sasso x Shika brown. In conclusion, it is observed in this study that fertility and hatchability in chicken is affected by the breed and the weight of the egg.

Keywords: Single Nucleotide Polymorphism, Hatchability, fertility, Sasso, Shika brown

Introduction

Domestic chickens (*Gallus gallus* domestica) are non-descriptive and heterozygous birds that are different in size, colour, shape and production ability depending on their genetic makeup. In Nigeria, the population of local chickens accounts for 80% (Ajayi and Agaviezor, 2012) and are of great importance to man both nutritionally, culturally and economically (Peters *et al*., 2008). Selection for production traits in the poultry industry (broiler and layer) has resulted in a rapid improvement in animal performance. For broilers, the main selection pressure has been on growth rate, feed efficiency, and

carcass traits, and in layers, the focus has been to increase egg production and quality (Fulton, 2012). However, although several traits have been genetically improved, phenotypic and genetic variations still exist among chicken populations due to differences in selection practices imposed by different breeding programs; therefore, improvements are required in this regard (Rönnegård and Valdar, 2011).

In poultry production, different factors ranging from environmental to genetic factors do affect egg production, fertility and hatchability of the eggs. Some of such factors include storage time, position of the eggs, relative humidity, temperature and feed variation (Mussaddeq *et al*., 2002; Al-Bashan and Al-Harbi, 2010). However genetic factors such as breed type, genetic makeup of the embryo, shell quality, egg size and disease also affect fertility and hatchability (King'ori, 2011). The productive value of animals is determined by its ability to meet production demand and the production potential of domestic fowl is controlled by several parameters including those related to its reproductive potential (fertility and hatchability of eggs). This study was therefore designed to assess the breed and egg weight influence on hatchability and fertility in Sasso, Shika Brown and their crosses in the South - South region of Nigeria.

Materials and method

This study was carried out at the University of Port Harcourt Demonstration Farm, Choba, Port Harcourt, Nigeria. Ten males and 100 females of Sasso and five males and 50 females of Shika brown donated by African Chicken Genetic Gains (ACGG) for capacity building were crossed by artificial insemination to generate a total of 1,107 eggs comprising 509 Sasso eggs (46 light, 285 medium, 178 heavy) 392 Shika brown egg (141 light, 97 medium, 154 heavy) and 205 Sasso x Shika brown cross (19 light, 145 medium, 42 heavy) were used for this study. The egg weights were classified as light (<50g), medium (50 – 59g) and heavy (60- 69g).

The eggs were collected, weighed and sent to the hatchery. Data on number of fertile eggs, number of fertile eggs hatched, fertile eggs not hatched, eggs not fertile, chicks dead in shell, deformed chicks and total number of eggs were collected and analyzed using SPSS version 16 using analysis of variance (ANOVA). Significant means were separated at $p<0.05$ using Duncan Multiple Range Test.

Results

Table 1 shows the effect of breed on fertility and hatchability parameters of the chickens studied. The results revealed a significant ($p<0.05$) effect of breed on the fertile eggs, fertile number of eggs hatched, fertile but not hatched eggs, eggs not fertile, chicks dead in shell, deformed chicks and total eggs. Sasso and Shika Brown had more fertile eggs as compared to Sasso x Shika Brown cross. For fertile eggs hatched, Sasso had the highest mean fertile eggs hatched (19.55±0.30). This was followed by Shika brown (14.88±0.30) and the least value was seen in Sasso x Shika brown cross (8.22±0.30). Also, considering fertile but not hatched eggs, the highest value was seen in Shika brown (8.77±0.30). This was followed by the Sasso and Sasso x Shika brown cross having the same value of 1.44±0.30. Sasso had the highest eggs not fertile (35.55±0.36). This was followed by Shika brown (19.88±0.36) and the least was observed in Sasso x Shika brown (13.22±0.36). Chicks dead in shell also varied significantly. The highest number was observed in Shika brown (1.77±0.21). Sasso had 1.11±0.21 and the least was observed in Sasso x Shika brown cross (0.33±0.21). The deformed chicks were

highest in Shika brown (0.66±0.11). Sasso and Sasso x Shika cross had no deformed chicks. Total eggs was highest in Sasso (56.55±0.36) and was followed by Shika brown (43.55±0.36) and the least was observed Sasso x Shika brown cross (22.88±0.36).

Table 1: Effect of breed on hatchability and fertility of Sasso, Shika brown and their cross

Breeds	Fertile eggs	Fertile eggs hatched	Fertile eggs not hatched	Eggs not fertile	Chicks dead in shell	Deformed chicks	Total number of eggs
Sasso	21.00[a]	19.55[a]	1.44[b]	35.55[a]	1.11[b]	0.00[b]	56.55[a]
Shika brown	23.66[a]	14.88[b]	8.77[a]	19.88[b]	1.77[a]	0.66[a]	43.55[b]
Sasso x Shika brown	9.66[b]	8.22[c]	1.44[b]	13.22[c]	0.33[c]	0.00[b]	22.88[c]
Least Square Mean	0.00	0.30	0.30	0.36	0.21	0.11	0.36

a, b, c: Means of different superscripts are significantly different (p<0.05)

Table 2 shows the effect of egg weight on fertility and hatchability parameters of the chickens studied. There was also a significant (p<0.05) effect of egg weight on the fertile eggs, fertile eggs hatched, fertile but not hatched eggs, eggs not fertile, deformed chickens and total eggs. Chicks dead in shell were not however significant. Shika brown had the highest fertile eggs and the least was observed in Sasso. Fertile eggs hatched were highest among medium weight (28.55±0.30). This was followed by the heavy weight eggs with a value of 13.66±0.30 and the least was observed among the light weight eggs (9.66±0.30). For fertile but not hatched eggs, the light weight eggs had the highest value of 4.88±0.30. This was closely followed by the heavy weight eggs with a value of 4.00±0.30. The least was seen in the medium weight eggs with a value of 2.77±0.30. However there was no statistical difference (p>0.05) between the light and heavy size eggs. For eggs not fertile, the highest significant value was observed in heavy weight eggs (27.88±0.36). This was followed by the medium weight eggs having a value of 27.22±0.36 and the least was seen in the light weight eggs (13.55±0.36). Chicks dead in shell were not significantly affected by egg weight. However, the medium and heavy weight eggs had equal value of 1.11±0.21 as compared to the light size egg with a value of 1.00±0.21. For deformed chicks, the highest significant value was seen in the light weight eggs with a value of 0.66±0.11. There were no deformed chicks in the medium and heavy weight eggs. For the total eggs hatched, the medium weight eggs had the highest value of 58.55±0.36. This was followed by the heavy weight eggs with a value of 41.55±0.36. The least was observed in the light weight eggs with a value of 22.88±0.36.

Table 2: Effect of egg weight on hatchability and fertility of Sasso, Shika brown and their cross

Egg size	Fertile eggs	Fertile eggs hatched	Fertile eggs not hatched	Eggs not fertile	Chicks dead in shell	Deformed chicks	Total number of eggs
Light	9.33[c]	4.44[c]	4.88[a]	13.55[b]	1.00	0.66[a]	22.88[c]
Medium	31.33[a]	28.55[a]	2.77[b]	27.22[a]	1.11	0.00[b]	58.55[a]
Heavy	13.66[b]	9.66[b]	4.00[a]	27.88[a]	1.11	0.00[b]	41.55[b]
Least Square Mean	0.00	0.30	0.30	0.36	0.21	0.11	0.36

a, b, c: Means of different superscripts are significantly different (p<0.05)

The interactive effect of breed and egg weight on hatchability and fertility of Sasso, Shika brown and their cross is shown in Table 3. The highest value of fertile eggs was observed in medium weight eggs of Sasso and the least in heavy weight of Sasso x Shika brown crosses. The highest value of fertile eggs hatched was observed in medium weight eggs of Sasso (41.00±0.53) while the least value was seen in light weight eggs of Sasso x Shika brown (1.33±0.53). For the number of fertile eggs not hatched, the highest was seen in light and heavy weight eggs of Shika brown (9.00±0.53). There were no eggs not hatched for Sasso for all egg weight groups. Furthermore, the highest eggs not fertile were observed in medium weight eggs of Sasso (50.00±0.63). This was followed by heavy weight eggs of Sasso (44.00±0.63) and the least was observed light weight eggs of Sasso x Shika brown. For number of chicks dead in shell, none was observed in light and heavy weight egg for Sasso, medium weight egg for Shika brown and Sasso x Shika brown. The highest value was observed in medium weight egg of Sasso (4.00±0.36). Deformed chicks were only observed in light weight eggs of Shika Brown (2.00±0.19) and heavy weight eggs of Sasso x Shika brown. Total number of eggs was highest in medium weight eggs of Sasso (95.00±0.63). This was followed by heavy weight eggs of Sasso (59.33±0.63) and the least was observed in light weight eggs of Sasso x Shika brown cross.

Table 3: Interactive effect of breed and egg weight on hatchability and fertility of Sasso, Shika brown and their cross

Bread	Egg weight	Fertile eggs	Fertile eggs hatched	Fertile eggs not hatched	Eggs not fertile	Chicks dead in shell	Deformed chicks	Total number of eggs
Sasso	Light	3.00	3.00	0.00	12.33	0.00	0.00	15.33
	Medium	45.00	41.00	4.00	50.00	3.33	0.00	95.00
	Heavy	15.00	14.66	0.33	44.33	0.00	0.00	59.33
Shika brown	Light	22.00	9.00	13.00	25.00	2.00	2.00	47.00
	Medium	23.00	21.33	1.66	9.33	0.00	0.00	32.33
	Heavy	26.00	14.33	11.66	25.33	3.33	0.00	51.33
Sasso x Shika brown	Light	3.00	1.33	1.66	3.33	1.00	0.00	6.33
	Medium	26.00	23.33	2.66	22.33	0.00	0.00	48.33
	Heavy	0.00	0.00	0.00	14.00	0.00	0.00	14.00
Least Square Mean		0.00	0.53	0.53	0.62	0.36	0.19	0.63

Discussion

The results of this study showed that difference in breeds has a significant effect on different hatchability parameters. The findings of this study is thus in line with the fact that hatchability and fertility performance of eggs depends on genetic factors (Islam *et al.*, 2002). Fertility and hatchability are interrelated heritable traits and they vary among breeds, variants and individuals within breeds and variants. However, Ashart *et al.* (2003) reported that there was no significant difference ($p>0.05$) in the fertility between Lyallpur silver black and Rhode Island Red interaction but between the hatches, significant ($p<0.05$) differences were observed. From this study, higher hatchability results were achieved in medium egg weight. This showed that jumbo size eggs and light weight eggs should not be set in the hatchery. However, maximum fertility was observed in the light

weight eggs. Similarly Hassan *et al.* (2005) reported that medium size eggs yield at least 75% hatchability compared to 50-70% hatchability of small and large eggs respectively. However in contrast Dewilt and Schwalbach (2004) observed that large eggs recorded higher percent hatchability in New Hampshire and Red Rhode Island chicken breeds. Another study also showed that large size eggs of indigenous Venda chickens had a higher hatchability than medium and small size eggs (Mbajiorgu, 2011). A negative correlation between egg size and hatchability in crossbred chicken was observed and heavier eggs resulted in low hatchability than medium size eggs (Farooq *et al*., 2001). Similarly, Wondmeneh *et al.* (2011) reported that medium size eggs of Potchefstroom keokeok chicks had the highest hatchability than large and small eggs size group. The results of this study is also supported by that of Durmus *et al.* (2010) who reported that fertility, late embryonic mortality (dead in shell), and hatchability differed between genotypes.

Conclusion

The study showed that genetic and non-genetic factors influenced hatchability and fertility in Sasso, Shika brown and Sasso x Shika brown cross. Effects of breeds and different egg weight on fertility and hatchability were apparent. The use of Sasso and Shika brown as well as medium weight eggs should be encouraged for better percentage of fertility and hatchability. However, understanding these factors and how they affect chicken reproductive or productive traits will help to develop practices to regulate hen productive performance at a profitable level.

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