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ORIGINAL RESEARCH ARTICLE

Reproductive Performance and First Egg Lay of Four Indigenous Chicken Genotypes in the Rainforest Zone of Nigeria

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ABSTRACT

A total of 377 eggs made up of 72 eggs from naked neck, 92 from frizzle feathered, 130 from normal feathered and 83 from short flight feathered chickens were incubated in three batches under controlled temperature and relative humidity in an experiment to compare egg fertility and hatchability of four indigenous chicken genotypes in the rainforest zone of Nigeria. Hatched chicks from the four genotypes were raised under intensive system of management to compare age and weight of hen at maturity as well as weight of first egg laid under the same environmental condition using complete randomized design. Mean computational values of the data were taken using Statistical Procedure for Social Sciences (SPSS) and they were expressed in percentage. The results showed that the naked neck was significantly (P<0.05) better in terms of body weight (955.17g) but similar with frizzle feathered chickens in terms of age at first egg (158days and 160days). However, naked neck chickens had the highest (72.09%) dead in germ, poorest fertility and hatchability of 59.71% and 23.24% compared with the frizzle feathered (53.05%, 71.73% and 46.96%) and the normal feathered chickens (36.55%, 71.54% and 63.45%) an indication that normal feathered chicken performed better than others in terms of fertility and hatchability percentages. It was concluded that apart from bodyweight and early laying trait advantages possessed by naked neck, the normal feathered indigenous chickens can be said to have better reproductive characteristic compared to the other chicken genotypes used in this study.

Keywords: Fertility, Hatchability, genotypes, indigenous chickens, bodyweight,

INTRODUCTION

Poultry population in Nigeria has been reported to be about 172 million, out of which chickens (indigenous and exotic) is estimated to have the largest of 160 million, with guinea fowl, duck and local turkey having 8.3 million, 1.7 million and 1.05 million respectively (FAOSTAT, 2011). Indigenous chickens comparatively have smaller body and egg size, a huge reservoir of genome resource that are broadly distributed in major rural household mostly because of their self dependent nature, high survivability rate, adaptation and adjustment to fluctuations in feed and adverse environment (Peters *et al.,* 2008). They are hardy birds, possesses the ability to brood and hatch their own eggs with appreciable resistance to endemic diseases over the years (Ikeobi, 2003; Peters *et al.,* 2007). They render services to man in various ways: dietary, mainly in form of meat and egg, research, droppings use as manure to replenish soil nutrients and also hold a special place in traditional medicine and worship of gods and deities (Atteh, 2004; Peters *et al.,* 2008). The low production of indigenous chicken by small holders coupled with the introduction of exotic type at commercial level has resulted to low supply of indigenous chicken meat and egg products. Low standard management, delayed maturity, small body and egg size among other reasons also added to the low production performance of the indigenous chickens (Gueye, 2000).

Atteh, (2004), defined incubation as the provision of conditions required for the successful development of a fertilized egg into a fully developed bird. This can be done naturally by the mother hen or by the use of a machine called incubator. Eggs hatching by chickens according to Onagbesan *et al.*, (2007) require interplay between a number of factors to promote the development of the embryo and hatch at appropriate length for incubation. Oke *et al.*, (2015) reported that some of the factors that promote the development of embryo and hatch to include the genetic line of the breeder, the background of the embryo, the weight of egg, eggs handling and factors associated with the environment such as relative humidity, temperature, gas levels and altitudes in which the eggs are stored and incubated. The development of the embryo needs a precise balance between these environmental factors so as so realize a desirable hatchability and chick quality. Bruggeman *et al*. (2002) reported that factors which can alter the internal and the external environment of the hatching egg do not only have repercussions on the embryonic development, hatching and day old chicks quality but also the post hatch growth performance. Data from Tona *et al.* (2004a) revealed that eggs storage and maturity of broiler breeder alters incubation, egg quality of post hatch growth and the embryonic physical parameters. Studies have revealed that the indigenous chickens possess immense potential for improvement (Peters, 2000; Adedeji *et al*., 2008; Adebambo *et al.*, 2009). This is due to their outstanding inherent advantages which include good fertility and hatchability, better flavoured meat and egg, high degree of compliance to prevailing environmental condition, high genetic tolerance, ease of rearing and ability to breed naturally. These authors reported that an egg failing to hatch is a considerable energetic loss to the bird that laid it, those that incubated it, the management of the animal, as well as to its nutrition. Similarly, egg fertility is affected by factors that are directly associated with the laying hen such as her ability to successfully mate, store sperm, ovulate an egg cell and finally produce a suitable environment for the formation and development of the embryo (Brillard, 2003).

Agaviezor, *et al.,* (2018) reported that productive value of animals is determined by its ability to meet production demand and that the production potential of domestic fowl is controlled by several parameters including early maturity and those relating to its reproductive potential (egg fertility and hatchability). Peters *et al.,* (2008) stated that fertility and hatchability of eggs are key determinant of profitability in the hatchery industry. Therefore, this study was conducted using indigenous chickens comprising the frizzle feathered, naked neck, normal feathered and the short flight feathered genotype to evaluate the reproductive performance and the first egg lay of four indigenous chicken genotypes in the rainforest zone of Nigeria with the aim of aim of comparing and identifying reproductive trait of comparative advantage among the different genotypes in the zone.

MATERIALS AND METHODS

Study Area

The experiment was carried out in the Poultry unit of the Department of Animal Science Teaching and Research Farm of Benson Idahosa University located in Ugbor, Benin City, Edo State, Nigeria. The area lies within the geographical coordinate of longitude 5° 04’ East and 6° 43’East and latitude 5° 44’

North and 7° 34'North in the rain forest ecological zone. It has a prevailing tropical climate with a mean annual rainfall of 2162mm, average annual temperature of 27.6° C and a mean relative humidity of 72%. (NAA, 2014).

Management of Experimental Chickens

Eighty four (84) chickens of about twenty weeks comprising of eighteen (18) hens and three (3) cocks each for naked neck, frizzle feathered, normal feathered and short flight feathered chickens purchased from small holders flocks in Kwara, Oyo, Osun and Edo States of Nigeria. They were brought to the poultry unit of Benson Idahosa University Teaching and Research Farm and were housed in previously cleaned, disinfected and properly netted pens with fresh wood shavings as litter material. Random mating scheme within genotype was done. Mating ratio of one cock to six hens (1:6) for the different indigenous chicken genotypes was maintained. Feeds and water were provided *ad-libitum* using feeders and drinkers that were adequately spaced. Nest boxes were provided in the pen for the hens to lay their eggs. At lay, the days of first lay and the weight of first eggs were recorded. At stable production, eggs were collected and tagged daily at regular interval of four (4) hours and stored in a dry cool place for a period of four (4) to five (5) days to accumulate sufficient number of eggs necessary for each setting before placing them in the incubator. It was ensured that the eggs selected for hatching in the different batches were free from cracks and dirt that could cause contamination.

Eggs Incubation: Brinsea ova-easy advanced series II egg incubator, (OE 380 model) was used to incubate the eggs for hatching in batches. In each batch, the eggs were arranged in the incubator crates with the broad end facing upwards to allow the hatching chicks access to the oxygen in the air space of the eggs were the turning of the eggs were done. The automatic turning device was set at one hour interval. The trays containing the eggs of the different chicken genotypes were partitioned on the 18th day after candling using hard cardboard to prevent chicks from mixing when hatched. The incubator temperature was set at 37.5°C and 60% relative humidity for 21 days. The other incubation procedure set by the manufacturer including automatic egg turning in opposite direction was followed.

Egg Fertility Test: Eggs fertility test was carried out on the 5th day of incubation using egg candler. This was done by exposing the eggs individually to a beam of light. The light strikes the eggs thus allowing the fertile eggs to be identified easily. The eggs that are fertile showed a spider like appearance due to radiating blood vessels. In contrast the non fertile eggs did not and are thus described as 'clear'. The percentage fertile eggs was calculated using the formula below.

$$\text{Fertile egg (\%)} = \frac{\text{No. of fertile eggs}}{\text{Total No. of eggs set}} \times 100$$

Germ Testing: This was carried out on the 18th day of incubation to ascertain whether the eggs that were observed to be fertile on the 5th day of incubation were still alive. As it was done for egg fertility test, the eggs were candled, the living germ had, clear air cell, while the remaining component of the egg is uniformly opaque. In contrast, the egg with a dead embryo showed opacity which was not uniform, with no distinct air cell. .

Percentage dead in germ was taken as the percentage of dead germ out of all the fertile eggs set and calculated using the formula:

$$\text{Dead in germ (\%)} = \frac{\text{No. of dead in germ}}{\text{No. of fertile eggs}} \times 100$$

Hatchability of all eggs set and fertile eggs were calculated using the formulae below:

Percentage hatch of all egg set = $\frac{No.\ of\ hatched\ chicks}{No.\ of\ all\ eggs\ set} \times 100$

Percentage hatch of fertile eggs = $\frac{No.\ of\ hatched\ chicks}{No.\ of\ fertile\ eggs} \times 100$

The hatched chicks were placed into four treatment base on their parental phenotypic feather distribution background. Each genotype were replicated thrice and assigned to their various pens in a completely randomized design. Routine management practice such as *ad-libitum* provision of feed and water was carried out. At point of lay, the day of first egg, the weight of first egg and the hen's weight at first egg were recorded to compute their maturity indices.

Statistical Analysis: Data collected were statistically analyzed with Statistical Procedure for Social Sciences (SPSS), 2011 version 16, using analysis of variance (anova) appropriate for complete randomized design and means were separated using Duncan multiple range test. The result of fertility and hatchability of the eggs were also subjected to descriptive statistics involving simple percentages.

RESULTS AND DISCUSSION

The first egg lay of four indigenous chicken genotypes with particular reference to age and body weight of hen at first egg laid as well as the weight of first egg laid is presented in Table 1. There was significant difference (P<0.05) among the experimental chickens with regards to mean age at first egg laid. Laying of eggs being the sure sign of maturity in hens, naked neck and frizzle feathered chickens attained maturity with evidence of laying first egg at similar period (158th and 160th day respectively) but normal feathered and short winged chickens laid their first egg at 179th and 177th day respectively. The age at first egg obtained from this study is earlier than what was reported by Mwalusanya *et al.* (2004), that the age at first lay of local chickens ranged between 6 and 8 months (180 to 240 days), the difference in sexual maturity may be due to the intensive management system adopted in this study. There was also significant difference (P<0.05) in the mean body weight of hens at first egg laid with naked neck (955.17g) having better body weight followed by frizzle feathered chickens (884.21g), the normal and the short flight feathered chickens had similar and lesser body weight of 840.53g and 836.41g respectively.

The egg fertility and hatchability of four indigenous chicken genotypes used in the study is presented in Table 2. The results showed that there were no significant difference (P>0.05) in the various chicken genotype with respect to the mean number of eggs set, number of fertile eggs, number of infertile eggs as well as the number of dead in germ. However, there were significant difference (P<0.05) in the number of living germ, with the normal feathered chickens having a significantly higher value (19.67 ± 2.33). The naked neck chicken had the poorest mean value of 4 ± 1.73. In order to eliminate ambiguity, egg fertility and hatchability of the four indigenous chicken genotypes were also expressed in percentages as shown in the same Table. Apart from the higher significant (P<0.05) differences in the number of living germ among the chicken genotypes there were also significant difference (P<0.05) in terms of dead in germ with naked neck chickens having 72.09%. The eggs percentage fertility of the different

Table 1: Maturity Indices of Four Light Weight Indigenous Chickens

Parameters	Naked neck	Frizzle feathered	Normal feathered	Short flight feathered	SEM
Mean Age at First Egg (days)	158[a]	160[a]	179[b]	177[b]	3.56
Mean Body Weight at First Egg (g)	955.17[a]	884.21[b]	840.53[c]	836.41[c]	16.91
Mean Weight of First Egg (g)	29.33	29.66	29.33	30.05	0.31

[a,b.c] Mean within rows carrying different superscripts differs significantly (P<0.05)

chickens also varied with frizzle and normal feather chickens showing above 71 % fertility, while the least percentage fertility of 59.71% was recorded in naked neck chicken. The highest percentage hatchability of 63.46 was recorded by the normal feathered chicken, followed by 46.96%, and 43.12% recorded by frizzle and short winged chicken respectively. The least and the poorest hatchability of 23.24% was recorded by the naked neck chickens. This result is not in tandem with the work reported by Ajayi, *et.al*. (2008) who reported low hatchability of 45% for normal feathered chickens compare to a range of 72 – 93.1% recorded for naked neck and frizzle feathered chickens, thus revealing higher hatchability percentage. However, it agreed with the report of Ajayi, (2010) stating that normal feathered chickens are most prominent than the other indigenous chicken genotypes having frequency distribution of 91.8% with naked neck, frizzle feathered and others occupying the remaining fraction of 8.2% (Ajayi and Agaviezor 2009). The prominence of normal feathered chickens over the other genotypes could be attributed to its high hatchability advantage. The eggs used in the study were produced from chickens of the similar age, reared in the same environment, fed same feed, same handling and nest hygiene, same storage and incubation condition. These were done to annul the effect of nutrition and environment as it relates to fertility and hatchability of the different chicken genotypes. Despite all of these, the four indigenous chicken genotypes used in this study exhibited variation in their fertility and hatchability percentages which is in agreement with the study of Durmus *et al.* (2010) which states that late period embryonic mortality, hatchability of fertile eggs and early embryonic mortality differs between genotypes. Islam *et al.* (2002) also revealed that difference in breed had significant effect on the different hatchability parameters as these characters are genetically controlled. The results of this study agreed with Fikremariam and Tilahun (2016) that state that amidst other factors hatchability performance of eggs depends on genetic factors but fertility are not affected. Fertility can be affected by the quality and quantity of semen deposited when mating the cock with the hen (Brillard, 2003; Gheiseri *et al.*, 2011).

Conclusion

This study has revealed that normal feathered indigenous chickens exhibited best reproductive performance in terms of egg hatchability traits among the four strains of indigenous chickens. In view of the results obtained in this study, it is recommended that the trait in normal feathered indigenous chickens that promote better hatchability be identified, harnessed and combined with the body weight and early egg lay advantages of naked neck to produce a hybrid that will possess both characteristics for breeding. Also egg incubation management should be improved upon to enhance increase hatchability of eggs.

Table 2: Percentage Fertility and Hatchability Traits of Four Indigenous Chicken Eggs

Parameters	Naked neck	Frizzle feathered	Normal feathered	Short flight feathered	SEM
Number of Eggs set	24.00 ± 10.54[a]	30.67 ± 5.55[a]	43.33 ± 8.74[a]	27.67 ± 6.17[a]	4.06
Number of Fertile Eggs	14.33 ± 9.35[a]	22.00± 3.51[a]	31.00 ± 3.61[a]	17.00 ± 3.06[a]	3.04
Fertile Eggs (%)	59.71	71.73	71.54	61.44	
Number of Infertile Eggs	9.67 ± 1.86[a]	8.33 ± 2.19[a]	12.33 ± 5.17[a]	10.67 ± 3.28[a]	1.51
Infertile Eggs (%)	40.29	28.27	28.46	38.56	
Number of Living germ	4.00 ± 1.73[c]	10.33 ± 2.03[b]	19.67 ± 2.33[a]	8.33 ± 0.33[bc]	1.88
Living germ (%)	27.91	46.95	63.45	49	
Number of Dead in germ	10.33 ± 7.84[a]	11.67 ± 2.03[a]	11.33 ± 4.81[a]	8.67 ± 2.73[a]	2.12
Dead in germ (%)	72.09	53.05	36.55	51	
Hatchability of all Eggs (%)	13.88	33.68	45.40	26.50	
Hatch of Fertile Eggs (%)	23.24	46.96	63.45	43.12	

[a,b.]Mean within rows carrying different superscripts differs significantly ($P<0.05$)

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