COMPARATIVE STUDY OF SEMEN CHARACTERISTICS, EGG FERTILITY AND HATCHABILITY OF NAKED NECK, FULANI ECOTYPE, ISA BROWN AND THEIR F_1 CROSSBREDS

***Adedeji, T.A[1]. Amao, S.R[2]. Mathew, O.C[1]., Fasoyin, O.A[1] and Olugbemiga, K.S[1]**

[1] *Department of Animal Production and Health, P.M.B.4000, Ladoke Akintola University of Technology, Ogbomoso, Oyo State, Nigeria.*

[2]*Department of Agricultural Education, (Animal Science Division, Animal Breeding and Genetics Unit), School of Vocational and Technical Education, P.M.B.1010, Emmanuel Alayande College of Education, Oyo, Oyo State, Nigeria.*

***Corresponding author email:**aadedeji1@gmail.com

Abstract

The study focus on the comparative assessment of semen characteristics, fertility and hatchability of naked neck, Fulani ecotype, Isa brown and their F_1 reciprocal crosses. A total number of fifteen sires and sixty dams belonging to three different strains of chicken were used for the study which comprises of five sires and twenty dams of naked naked, Fulani ecotype and Isa Brown chickens. These birds were involved in the reciprocal mating and data were collated on the semen characteristics of the sires (semen volume, sperms motility, morphology, concentration, pH, live and dead sperms), egg set, fertility and hatchability of the eggs after the reciprocal crossing. Significant ($P<0.05$) effect values of semen volume (0.30ml) was obtained for naked neck Isa brown crossbred (NNIB), sperm motility (90.65%) for Fulani ecotype Isa brown crossbred (FEIB), sperm morphology (89.35%) for Isa brown, sperm concentration (68.90) for FEIB, % live sperm (88.70%) for FEIB while least values of sperm pH (10.40) and % dead sperm (11.31%) was obtained for FEIB. The results showed that Fulani ecotypes had highest eggset (100%), fertile eggs (93.10%), hatchable eggs (100%), lowest infertile egg (6.90%) and dead in shell (0.00%) while the combine effect favoured FEIB in terms of eggs set, fertile eggs, infertile eggs, hatchable eggs and dead in shell than NNIB genotype. The present results indicated that FEIB genotype performed better than other genotypes group in terms of semen quality while Fulani ecotype was favoured in respect of fertility and hatchability.

Keywords: Semen quality, egg, fertility, hatchability, local birds, Isa brown

Introduction

Semen quality remains one of the most important characteristics that determine fertility in the male. The importance of raw semen assessment to identify males of different fertilizing abilities is routinely employed (Wishart, 2009). In all poultry species, semen quality parameters vary with age of the male, leading to a progressive decline in fertility with age (Kotlowska *et al.*, 2005). It is important to characterize the quality parameters in terms of semen volume, semen colour, sperm concentration, sperm motility, sperm viability and morphology. According to Wolc and Olori (2009), fertility and hatchability are susceptible to genetic and environmental factors arising from various sources. Cocks reproductive performance has a major impact on the reproductive efficiency of poultry operations (Bakst *et al.*, 1994; Adenokun and Sonaiya, 2001).Semen characteristics of poultry birds may be an excellent indicator of reproductive potentials and major determinants of fertility (Peters et al., 2004). Therefore, the aim of this study is to compare the semen characteristics, egg fertility and hatchability of naked neck, Fulani ecotype, Isa Brown and their F_1 crossbreds with a view to know and recommend bird(s) with better genetic potentials.

Materials and Methods

Experimental Site

The experiment was carried out at the Poultry Unit of Teaching and Research Farm, Ladoke Akintola University of Technology, Ogbomoso, Oyo State, Nigeria. The site is located in the derived savannah zone of Nigeria on longitude 4°15' East and latitude 8°15'North east of the Greenwich meridian. The altitude is between 300 and 600m above the sea level. The mean annual rainfall and temperature are 1247 mm and 27°C respectively.

Experimental Birds and Management

The experimental birds consist of fifteen sires and sixty dams belonging to three different strains. The three strains were two indigenous (Naked neck and Fulani ecotype) and an exotic (Isa brown) chicken. The indigenous chickens used as parent stock were sourced from LAUTECH Teaching and Research farm while the exotic birds were purchased from a reputable farm in Ibadan, Nigeria. The birds were individually wing tagged for identification purposes. Sires and dams were caged in previously

disinfected open-sided house providing a battery cage space of 1800 square inches. Each bird was confined in a cell space of 15 x 15 inches.

Experimental Feeds and Feeding

The parent stock were fed were *ad-libitum* with commercial breeder mash containing 17.5% crude protein and 2700kcal/kg Metabolizable energy. Clean water was also supplied *ad- libitum*. Medications and vaccinations were done as required.

Semen collection and experimental mating

At 22 weeks of age, the cocks were trained for semen collection using the massage techniques described by Adedeji *et al.* (2015). Prior to semen collection, feathers around the sire's vent were shaved at regular intervals. Semen from each cock was collected into a collection cup in the evening (1700hrs) and taken to the laboratory for analysis. 0.1m semen collected subsequently was used to inseminate each hen.

The mating procedure is as follows;

Naked neck (Male) x Naked neck (Female) = $NN_m x Nn_f$

Fulani Ecotype (Male) x Fulani Ecotype (Female) = $F E_m$ x $F E_f$

Isa Brown (Male) x Isa Brown (Female) = $I B_m$ x $I B_f$

Naked Neck (Male) x Isa Brown (Female) = $N N_m$ x $I B_f$

Fulani Ecotype (Male) x Isa Brown (Female) = $FE_m x IB_f$

Egg Collection and Incubation

Eggs from artificial inseminated hens were collected, pedigreed along genotype lines and allow to accrue in a cool room at 18°C to 20°C for five days before the eggs were taken to the hatchery for incubation. The eggs were set along the genotype lines at a temperature between 27 - 39°C and at a relative humidity of 55 – 56% for eighteen days, the temperature was then increased to 29 - 40°C and at a relative humidity of 70 – 75% from nineteenth day to hatching time. The eggs were also turned automatically through 90° in the incubator.

Candling was carried out on the 18th day of incubation for the identification of fertile eggs, and clear eggs. The process was carried out in a dark room using a Candler fixed with a neon fluorescent tube. Numbers of fertile, infertile and embryonic mortality were recorded. After candling, the fertile eggs were transferred into the hatchery unit and at 21st day after the chicks hatched, they were left in the hatchery until 90% dried. Numbers of hatched chicks including the normal, weak, abnormal chicks and dead chicks were recorded.

Chick rearing, management and egg laying

Chicks obtained from the hatchery were identified and pedigreed along sires and dams lines, brooded for 4 weeks and fed with commercial chick mash till 8 weeks when it was changed to layers mash. After 20 weeks, the hens in each genotype were retained for egg production.

Data Collection

(a). Data obtained on the semen quality of the experimental cocks include, semen volume (ml), sperm colour, sperm motility (%), sperm morphology (%), sperm concentration ($x10^6$), live and dead sperm (%) and sperm pH according to the methods described by Ameen *et al.* (2014).

(b). When the birds were twelve weeks into laying, the following parameters were obtained, egg set per genotype, number and percentage of fertile eggs, number and percentage of infertile eggs, number of eggs hatched and hatchability percentage, number of dead in shell and percentage were obtained by procedure described by Adedeji *et al.* (2015).

Data Analysis

Data on semen traits were collected for genotype effect and subsequently subjected to One-way analysis of variance in a Completely Randomized Design using the procedure of SAS (2003) and significant means were separate with the same procedure of SAS (2003). The below model is adopted:

$Y_{ij} = \mu + a_i + e_{ij}$

Where,

Y_{ij} = individual observation

μ = overall mean

a_i = fixed effect of i^{th} genotypes (1, 2, 3, 4, 5)

e_{ij} = experimental errors which is evenly distributed.

Data obtained on fertility and hatchability of egg set were expressed as simple percentages

Results and Discussion

Table 1 shows the mean values of semen characteristics as affected by genotypes. Semen characteristics were significantly affected ($P < 0.05$) by chicken genotype. Cocks belonging to Naked neck Isa brown genotype had the highest semen volume (0.30ml), followed closely by those of Fulani ecotype (0.29ml) and the lowest value was recorded in the Isa brown (0.06ml) cocks. This observation is in accordance with the findings of Haunshi *et al.* (2011) for Aseel and Kadaknath chickens in Indian and Ajayi *et al.* (2014) for Nigerian indigenous and exotic chicken breeds. On sperm motility, cocks of Fulani ecotype x Isa brown genotype had the highest value of motile spermatozoa with a value of 90.65% and the lowest

Table 1: Mean values of semen characteristics as affected by genotypes

Variables	NN	FE	IB	NNIB	FEIB
Semen volume (ml)	0.11±0.05^{b}	0.29±0.12^{ab}	0.06±0.02^{c}	0.30±0.01^{a}	0.28±0.08^{ab}
Sperm motility (%)	82.79±0.47^{b}	84.93±1.99^{ab}	87.45±2.45^{ab}	81.15±1.15^{b}	90.65±2.69^{a}
Sperm morphology (%)	84.60±0.29^{ab}	87.27±1.72^{ab}	89.35±3.04^{a}	82.02±0.94^{b}	87.41±1.17^{ab}
Sperm conc.(x10^{6})	50.40±9.13^{c}	68.90±1.87^{a}	69.70±0.70^{a}	56.70±7.10^{b}	68.50±0.30^{a}
Sperm pH	13.20±0.81^{a}	11.80±1.10^{ab}	10.60±0.15^{b}	10.50±0.01^{b}	10.40±0.01^{b}
Live Normal (%)	84.10±1.31^{ab}	87.40±2.10^{ab}	88.70±2.65^{a}	81.40±0.85^{b}	88.70±0.73^{a}
Dead sperm (%)	15.95±1.31^{ab}	12.65±2.10^{ab}	11.34±2.65^{b}	18.63±0.85^{a}	11.31±0.73^{b}

^{a,b,c} Means along the same row having different superscripts are significantly different at P<0.05.
NN=Naked neck, FE=Fulani ecotype, IB=Isa brown, NNIB=Naked neck Isa brown crossbred, FEIB=Fulani ecotype Isa brown crossbred.

Table 2: Absolute values and percentage of egg set, fertility and hatchability estimated in different chicken genotypes.

Genotypes						
Variables	N	NN	FE	IB	NNIB	FEIB
Egg set	181	33	29	74	17	28
Fertile egg	134	29 (87.88%)	27 (93.10%)	53 (71.62%)	9 (52.94%)	16 (57.14%)
Infertile egg	47	4 (12.12%)	2 (6.90%)	21 (28.39%)	8 (47.10%)	12 (42.86%)
Hatchable egg	119	21 (72.41%)	27 (100%)	48 (90.57%)	7 (77.80%)	16 (100%)
Dead in shell	15	8 (38.10%)	0 (0%)	5 (10.42%)	2 (28.57%)	0 (0%)

N = Number of observation, NN = Naked -neck, FE = Fulani ecotype, IB = Isa -brown, NNIB = Naked-neck Isa brown crossbred, FEIB = Fulani ecotype Isa-brown crossbred.

value obtained by Naked neck x Isa brown genotype (81.15%). This is in agreement with the studies of Pornjit *et al.* (2013) for Lueng hang kooa, Pradoo hang dam and Chee chickens and Almahdi *et al.* (2014) for Lingnan, Bingkok, kedu and Arabic chickens. Regarding sperm morphology, Isa brown had the highest value (89.35%) followed by the value of Fulani ecotype x Isa brown cocks (87.41%) and while the smallest value was observed in the Naked neck x Isa brown genotype (82.02%). On sperm concentration, Fulani ecotype Isa x brown had the highest concentration with a value of 69.90 x10^{6} and cocks of naked neck had the lowest concentration (50.40 x10^{6}). These observations on both sperm morphology and concentration agreed with the findings of Ameen *et al.* (2014) for local and exotic breed of chickens. The sperm pH obtained ranged from 13.20 to 10.40 with Naked neck recording the highest value of 13.20. % live normal sperm was highest in the cocks belonging to Isa brown and Fulani ecotype x Isa brown genotypes (88.70%, 88.70%), followed closely by Fulani ecotype (87.40%). % dead sperm was highest in the Naked neck x Isa brown genotype (18.63%) with the lowest value obtained in the Fulani ecotype x Isa brown cocks (11.31%). These documentations on pH, live and dead sperms disagreed with the observations of Ameen *et al.* (2014) and Ajayi *et al.* (2014). These authors noted lower values of pH, live and dead sperms for local and exotic breeds of chicken.

Table 2 revealed the absolute values and percentage of egg set, fertility and hatchability in the eggs from different chicken genotypes. Out of the varied number of egg set in each genotype, Fulani ecotype had the highest fertility (93.10%) followed by naked neck genotype and lowest was obtained in the naked neck x Isa Brown crosses. Infertile eggs observed were highest in naked neck x Isa Brown crosses (47.10%) with the lowest value of 6.90% in Fulani ecotype hens. These current reports on egg set, fertile eggs and infertile eggs are in agreement with findings of Fayeye *et al.* (2005) and Adedeji *et al.* (2015). These authors recorded similar findings in favour of Fulani ecotype. Out of the fertile eggs set for hatching, Fulani ecotype and Fulani ecotype x Isa brown crosses had the highest hatchable egg (100.0%) while the lowest value was recorded in the naked-

neck (72.41%) genotype. Dead in shell was highest in the naked neck hen's eggs (38.10%) with the lowest value obtained in the Fulani ecotype and Fulani ecotype x Isa brown genotype. Interestingly, the combining effect of Fulani ecotype x Isa brown genotypes in respects to hatchable eggs and lowest dead in shell was agreed with findings of Bobbo *et al.* (2013) for combining effects of three local chickens and Zelleke *et al.* (2005) for crosses of Rhode Island red and White leghorn breeds.

Conclusion

The present results indicated that Fulani ecotype x Isa Brown crossed performed better than other genotypes group in terms of semen quality while Fulani ecotype genotype was favoured in respect of fertility and hatchability.

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