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EVALUATION OF SEMEN CHARACTERISTICS INFLUENCED BY BREED, AGE AND ESTIMATION OF THE GENETIC PARAMETERS FOR SEMEN QUALITY TRAITS OF NIGERIAN INDIGENOUS CHICKENS RAISED IN HUMID TROPICS

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ABSTRACT

Much focus has been on other productive traits while less attention had been paid to semen traits in both commercial and local breeds of chicken. The reproductive traits of improved Nigeria local chicken were evaluated using three genetic groups (GG) identified as GG1 (normal feathered x normal feathered), GG2 (naked necked x naked necked), and GG3 (naked necked x normal feathered). A total of 45 cocks (15 cocks from each genetic group) were used and study lasted for 8 months. Semen traits evaluated include: semen volume and pH, sperm concentration, morphology, motility, proportion alive and viability. Data were analysed using multivariate analysis for the semen traits and genetic parameters were estimated using pooled data from the genetic groups. The result showed that genetic group significantly ($p < 0.05$) influenced all semen traits except semen volume, pH and sperm viability. Age of cocks also affected ($p < 0.05$) semen quality. Positive and highly significant ($P < 0.01$) moderate to very strong phenotypic correlations ranging from 0.29 (semen volume and semen pH) to 0.94 (active motility and live sperm) were found among the semen traits. Repeatability estimates were high for semen pH, normal morphology, sperm concentration and semen volume indicating that selection of cocks based on these traits can be done with single or few observations. Based on the present findings, the three genetic groups studied could be used as parent stocks for local chicken poultry production in Nigeria.

Key words: Indigenous Cocks, Genotype, Age, Repeatability, Semen Quality

Description of Problem

In Nigeria, many especially the rural masses are unable to meet the baseline of FAO recommendation, which is 56 grams of animal protein per caput per day at minimum (FAO, 1998), due to high cost of animal products (Fasuyi, 2005). Chickens have emerged as the most profitable and generally accepted source of animal protein across various religious, cultural and social milieus. Local breeds are treasured genetic assets for every country due to their ruggedness to adverse weather conditions as well as resistance against diseases prevalent to their environment (Begli *et al.*, 2010). Previous studies have highlighted the rich genetic potentials of the Nigerian local chickens (Oleforuh-Okoleh, 2013), their genetic merits have not been optimally utilized in order to incorporate them into commercial poultry production (Padhi, 2016). The genetic attributes of Nigerian indigenous chickens could be harnessed by application of improved genetic management practices and use of artificial Insemination (AI) in breeding programmes (Machebe and Ezekwe, 2004). The assessment of semen quality characteristics of cocks gives an excellent indication of their reproductive potential as it is a major determinant of fertility and subsequent hatchability of eggs (Peters *et al.*, 2004). The semen quality and quantity are influenced by an array of factors that include: breed and strain of chicken, genetic selection for



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higher egg production, seasonal differences, time of semen collection, (Shanmugam *et al.*, 2012). Various studies have reported semen quality for indigenous breeds of chicken (Kabir *et al.*, 2007, Hu *et al.*, 2013, Isidahomen *et al.*, 2014, Adamu *et al.*, 2019 and Adeoye *et al.*, 2017) and demonstrated to large extent typical variations. Successful acceptability and incorporation of these genetic groups into large scale production requires knowledge of their production potential and genetic merits. The present study was aimed at investigating the influence of breed type, age and genetic parameter estimates on semen quality traits in two types of improved Nigerian indigenous chicken - naked necked, normal feathered, and their cross.

Materials and Methods

The study was carried out at the Poultry Unit of the Department of Animal Science Teaching and Research Farm, Rivers State University, Nkpolu-Oroworukwo, Port Harcourt. Three genetic groups (GG) identified as GG1 (normal feathered x normal feathered), GG2 (naked necked x naked necked), and GG3 (naked necked x normal feathered) consisting of 45 cocks (15 cocks from each genetic group) were used. The abdominal massage method of semen collection for poultry was used to extract semen from individual cocks every 12 weeks, from 28 weeks to 52 weeks of age. The following traits: semen motility, volume, pH, sperm concentration, sperm morphology, live sperm and viability were evaluated with the aid of light microscope and haemocytometer at warm stage in line with Sorensen (1976) and Sexton (1981)

Statistical analysis

Data obtained from semen traits were subjected to multivariate analysis using General Linear Model of SPSS (2012) with genetic group and age as fixed factors. Means considered significantly different at $p < 0.05$, were separated using Duncan multiple range test.

Results and Discussion

The effect of genetic group on semen and reproductive traits of improved Nigerian local chickens studied is presented in Table 1.

Table 1: Effect of genetic group on semen traits of three Nigerian local chicken strains

Traits	GG1	GG2	GG3	SEM	p-value
Semen volume (mL)	1.05	0.83	0.92	0.13	0.095
Semen pH	7.96	7.93	7.92	0.05	0.526
Sperm conc ($\times 10^9$)	5.95 ^a	5.43 ^{ab}	4.44 ^b	0.57	0.020
Normal morphology (%)	73.06 ^a	72.40 ^a	64.19 ^b	3.05	0.006
Active motility (%)	70.49 ^a	70.02 ^a	58.56 ^b	3.67	0.021
Live sperm (%)	83.04 ^a	80.31 ^a	70.20 ^b	3.40	0.002
Viability (%)	72.40	72.64	65.95	3.45	0.180

Values within each row with different superscript are significantly ($p < 0.01$) different

Genetic group significantly ($p < 0.05$) affected proportion of sperm concentration, normal morphology, actively motile and live sperm cells while no disparity ($p > 0.05$) due to genetic group were observed in semen volume, semen pH and sperm viability. The significant effect of genotype on semen characteristics agrees with study of (Ajayi and Agaviezor 2009, Machebe and Ezekwe 2004, Isidahomen *et al.*, 2014, Adamu *et al.*, 2019 and Adeoye *et al.*, 2017) but disagrees with study of (Siudzinska and Lukaszewicz 2008 and Long *et al.*, 2010) who found no effect of breed on sperm characteristics. This variation may be due to difference in genetic make-up of the birds, different ecological environment, time of collection, frequency of semen collection, as



well as nutrition and body size of birds. The values for semen characteristics obtained in the present study are within the range for successful artificial Insemination.

The effect of age on semen and reproductive traits of improved Nigerian local chickens studied is presented in Table 2.

Table 2: Effect of age on semen traits of three Nigerian local chicken strains

Traits	28	40	52	SEM	p-value
Semen volume (mL)	0.63 ^c	0.80 ^b	1.37 ^a	1.2	0.000
Semen pH	7.93	7.91	7.97	0.05	0.398
Sperm conc (x10 ⁹)	5.95 ^a	3.76 ^b	6.12 ^a	0.56	0.000
Normal morphology (%)	74.73 ^a	60.09 ^b	74.83 ^a	2.89	0.000
Active motility (%)	71.60 ^a	54.37 ^b	73.09 ^a	3.88	0.000
Live sperm (%)	82.77 ^a	66.29 ^b	84.48 ^a	3.36	0.000
Viability (%)	73.27 ^a	60.48 ^b	77.24 ^a	3.61	0.000

Values within each row with different superscript are significantly ($p < 0.01$) different

The age at which semen was harvested from cocks affects the characteristics both quantitatively and qualitatively (14). Semen volume, normal morphology, active motility, sperm concentration, live sperm and sperm viability were significantly ($p < 0.01$) different across all ages considered. Apart from semen volume, semen quality at 28 and 52 days of age were better than results obtained at 40 weeks of age. The result of this study affirms the findings of (Shanmugam *et al.*, 2012 and Adeoye *et al.*, 2017). The phenotypic association between the semen traits studied is presented in Table 3.

Table 3: Phenotypic correlation among semen quality traits of three Nigerian local chicken strains

	Semen pH	Semen Conc	Normal Morph	Active Motility	Live sperm	Viability
Semen Volume	0.29*	0.34*	0.3*	0.38**	0.34*	0.39**
Semen pH		0.38*	0.35*	0.42**	0.46**	0.45**
Sperm Conc			0.88**	0.87**	0.80**	0.83**
Normal morphology				0.93**	0.86**	0.93**
Active motility					0.94**	0.92**
Live sperm						0.86**

** $P < 0.01$, * $P < 0.05$

Phenotypic correlation was estimated using pooled data from the three genetic groups across the age periods studied. The positive correlation between sperm motility and sperm count, semen volume and sperm count affirms the report of (Bah *et al.*, 2001). This study also agrees with the report of (Hu *et al.*, 2013) who reported a positive phenotypic correlation between semen traits in Beijing-You cocks, although the values obtained seem to vary. These variations in figure may be attributable to genetic and environmental factors. The findings of this study disagrees with the report of (Ewuola *et al.*, 2011) who recorded a negative correlation between semen volume and motility (-0.78) and live sperm (0.49) respectively. This invariably implies that,



performances of cocks for the various traits were interrelated positively. Repeatability estimates for semen traits using data obtained from the entire population (the three genetic groups) are summarized in Table 4.

Table 4: Repeatability estimate for semen quality traits^a of three Nigeria local chicken strains

Traits	σ^2_i	σ^2_w	R
Semen Volume	0.1819	0.1874	0.50
Semen Ph	0.0298	0.0233	0.56
Sperm Conc	45768.6750	46220.1900	0.50
Normal morphology	168.1710	137.9160	0.55
Active motility	160.8460	249.9100	0.39
Live sperm	134.1860	214.9030	0.38
Viability	141.814	195.7370	0.42

^a using pooled data from the three genetic groups. σ^2_i = variation between individuals. σ^2_w =variation between measurements within individuals. R = Repeatability value

The repeatability estimate obtained from this study for motility is higher than the value (0.33) reported by (Marini and Goodman, 1969). They also recorded 0.51,0.74 and 0.95,0.90 for sperm concentration and semen volume respectively in both low and high lines chicken. High repeatability estimate in this study for semen volume was in agreement with the reports of (Rajuana *et al.*, 2008). The values obtained in this study for sperm concentration (0.50) and normal morphology (0.55) contradicts the findings of (Dhillion *et al.*, 1975) who reported low repeatability of 0.35 and 0.31 respectively. Traits with high estimates revealed that the cocks' producing ability can be estimated from one or few observations. Moderate to high repeatability values of the spermatological traits observed indicates that environmental factors had minimal effect on understudied traits.

Conclusion and Application

Selection of roosters on the basis of sperm attributes may be one of the useful tools in AI practices aimed at genetic improvement for breeds and reduce cost of importing exotic breeds used for breeding.

References

- Adamu, J, Dauda, A, & Abbaya, H. Y (2019) Effect of Genotype and Seasons on Semen Characteristics of Three Indigenous Cock Types in the Semi-Arid Zone of Nigeria. *Journal of Animal and Veterinary Sciences*.5,(2),PP 9-15
- Adeoye, G.O., Oleforuh-Okoleh,V.U. & Chukwuemeka, U.M. (2017). Influence of breed type and age on spermatological traits of Nigerian local chickens. *Agro-Science*. 16.11.10.4314/as.v16i1.3.
- Ajayi, F.O. & Agaviezor, B.O. (2009). Phenotypic characteristics of indigenous chicken in selected local government areas in Bayelsa state, Nigeria. *Proceedings of the 3rd Nigerian International Poultry Summit. Feb. 22-26 Abeokuta*, Pp: 75-78.
- Bah, G.S., S.U.R. Chandhari & J.D. Al-Almin, 2001. Semen characteristics of local breeder cocks in the Sahel Region of Nigeria. *Revue Elev. Med. Vert Pays Trop.*, 54(2): 153-158.
- Begli, H. Emamgholi, Zerehdaran, S., Hassani, S., Abbasi, M. A. & Ahmadi, A.R. Khan (2010). Heritability, genetic and phenotypic correlations of egg quality traits in Iranian native fowl. *British Poultry Science*, 51:6, 740 — 744.
- Dhillion, J.S., Achary, R.M. and Singh R.N. (1975). Repeatability of semen characteristics in rams. *Indian journal of animal science*. 15: 594-595.
- Ewuola, E.O., Osaiyiwu, O.H., Sokunbi, O.A., Hassan, M.B. Olakanmi, I.G. & Balogun, A.S. (2011). Semen qualities of normal and frizzle feather breeding groups of domestic cocks treated with or without tocopherol. *Tropical Animal Production. Invest.* 14(1):30-35. ISSN: 1115-24540.
- FAO (1998). Village chicken production systems in Africa, by A.J. Kitalyi, AGA Rome
- Fasuyi, A.O. (2005). Nutritional evaluation of cassava (*Manihot esculenta*, crantz) leaf protein concentrates (CIPC) as alternative protein source in rat assay. *Pakistan Journal of Nutrition*, 4:50-56.
- Hu, J., Chen, J.L., Wen, G.P., Zhao, M.Q. & Wang, Z.W. (2013). Estimation of genetic parameters of semen quality in Beijing-You chickens. *Poultry Science*, 92:2606-2612.
- Isidahomen, C. E., Okpeku, M. & Osezua, K. E (2014) Semen Characteristics, Biochemistry and Mineral Content of Indigenous Cocks in Nigeria. *International Journal of Applied Research and Technology*. 3, (5)70 – 75.
- Kabir, M. Oni, O.O. & Akpa, G.N. (2007). Osborn selection index and semen traits interrelationship in Rhode Island Red and white breeder cocks. *International Journal of Poultry Science* 6: 999 -1002.

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AGRICULTURE AMIDST
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13. Long, J. A. Bongalhardo, D. C, Pelaez, J, Saxena, S. Settar, P. Sullivan, N.P.O. and Fulton, J. E (2010). Rooster semen cryopreservation: Effect of pedigree line and male age on post-thaw sperm function. *Journal of Poultry Science*. 89(5): 966-973
14. Machebe, N.S. and Ezekwe A.G. (2004). Ejaculate characteristics of three genotypes of local cocks in the humid tropics. *Journal of Tropical. Agriculture, Food, Environment and Extension*, 3(2).
15. Marini, P.J. & Goodman, B.L. (1969). Semen characteristics as influenced by selection for divergent growth rate in chickens. *Poultry Science*, 48: 859-865.
16. Oleforuh-Okoleh, V.U. (2013). Genetic gains from within breed selection for egg production traits in Nigerian local chicken. *ARP Journal of Agricultural and Biological Science*. 8: 788-792.
17. Padhi, M.K. (2016). Importance of indigenous breeds of chicken for rural economy and their improvements for higher production performance. A Review Article. *Scientific* (2016). Retrieved from <http://dx.doi.org/10.1155/2016/2604685>
18. Peters S.O. Omidiji, E.A., Ikeobi, C.O.N. Ozoje, M.O. & Adebambo, O.A. (2004). Effect of naked necked and frizzled gene on egg traits, fertility and hatchability in local chicken. In: self-sufficiency of animal protein in Nigeria. *Proceedings of the 9th Annual Conference of Animal Science Association of Nigeria* at Ebonyi, State University, Abakaliki, on September 13-16th, pp: 262 – 264.
19. Rajuana, A.K., Tayabur, M.R., Wilson, J.G., Hoque, M.A., Husain, S.S. & Sultana, Z. (2008). Repeatability estimates for seminal traits and their phenotypic relationships with testes measurements and performance traits in black Bengal buck. *Bangladesh Journal of Animal Science*, 37:34-41.
20. Sexton, T.J. (1981). Evaluation of semen quality and establishment of its correlation with fertility, In: *Reproductive Efficiency in Turkeys. Western Regional Research Publication W-142*:1-23.
21. Shanmugam, M., Rajkumar, U., Reddy, M.R. & Rama Rao, S.U. (2012). Effect of age on semen quality in naked neck and dwarf chicken under tropical climate conditions. *Animal Production Science*, 52:964-968.
22. Siudzinska, A. and Lukaszewicz, E. (2008). Effect of semen extenders and storage time on sperm morphology of four chicken breeds. *Journal of Apply Poultry Resource*. 17(1): 101-108.
23. Sorensen, J.A.M. (1979). *Repro. Lab. A Laboratory Manual for Reproduction*. 3rd Edition. Rendell/Hunt Publishing Co. IOWA, 151p.