APRW -08

Evaluation of Semen Characteristics of White and Black Plumage Improved Nigerian Local Chicken (FUNAAB ALPHA)

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Abstract
This study was carried out to evaluate the semen characteristics including semen pH, volume, normal and abnormal morphology, actively and sluggishly motile, sperm count and viability, using data obtained from 15 birds originating from improved Nigerian local chickens (8 white plumage and 7 black plumage) of 28 – 36 weeks of age. The result indicates that significant difference ($p<0.05$) exist between normal and abnormal morphology – 74.16 and 67.85; 26.25 and 32.85 for white and black plumage colour cocks respectively. The semen pH and volume between the white and black plumage cocks recorded no significant difference ($p<0.05$). Both sperm count and percentage dead were significantly higher in the black plumage strain. The percentage motility for actively and sluggishly motile were 79.37 and 66.19; 13.12 and 16.90 for white and black plumage respectively. All the traits evaluated were significantly influenced by the age of the cocks. Semen pH, concentration and volume, normal morphology, actively motile, and percentage live increased with age, though variation was found in sperm percentage dead and sperm count at 32 and 36 weeks of age, indicating that some of these traits could be used to ascertain semen condition at various age.

Keywords: Semen quality, Morphology, local chicken, motility, plumage colour

Introduction

Fertility and hatchability determine the major part of profit in the hatching industry. Good and improved poultry breeding management practices such as semen evaluation is recommended in genetic improvement of poultry species because it allows favorable selection for desired trait to be made when breeding cocks with very low motile sperm but has certain needed characters, by application of Artificial Insemination to keep those specific traits (Byrd *et al.,* 2003). The reproductive efficiency of poultry birds to a large extent is determined by the quality of semen produced by the cock (Islam *et al*., 2002). Semen quality characteristics assessment of poultry birds gives a perfect indicator of their reproductive potential and it is a major fertility determinant and subsequent hatchability of eggs (Peters *et al*., 2004).

In poultry breeding, the primary concern of a breeder is production of hatchable eggs and this can be realized by the evaluation of semen with excellent quality traits that can yield good fertility (Byrd *et al*., 2003; Peters *et al.,* 2004). Several factors are known to affect semen quality in cocks, such as breeds, diseases, age and time of collection, plumage colour, body weight and degree of development of the secondary sexual characters (Zuk *et al.,* 1995). Waseem *et al.* (2017) reported discrepancies in the semen characteristics of brown, black and white plumage colour cocks whereas Udeh *et al.* (2011) cited differences in exotic and local cocks with the latter producing more semen. The reliance on the evaluation of semen by use of colour and volume parameters in the past, gave estimates of sperm quantity (Okereke *et al.,* 2008; Tarif *et al.,* 2013).

The objective of this study was to evaluate the semen characteristics of white and black plumage improved Nigerian local chickens (FUNAAB Alpha).

Materials and Methods

The experiment was carried out at the Poultry Unit of the Teaching and Research Farm of the Department of Animal Science, Rivers State University, Nkpolu-Oroworukwo, Port Harcourt, South-South of Nigeria. A total of 15cocks comprising 8 cocks with white plumage colour (strain 1) and 7 cocks with black plumage colour (strain 2) were used for the experiment. The two improved local chicken strains were procured from the Poultry Breeding Unit of the Federal University of Agriculture (FUNAAB) Abeokuta, Ogun State. These breeds were offspring of a research project that started over 15 years ago in Abeokuta.

Semen collection: The collection of semen from the white and black plumage colour Nigerian local cocks of ages 28, 32 and 36 weeks was achieved by the abdominal massage technique (Lierz, 2008). The cocks were trained three weeks before collection commenced and during the collection process they were massaged and in response there was partial aversion of the cloaca thereafter semen was collected from the ventral lip of the vent in a tube maintained at 38 - 40^{0}C. The semen was subjected to microscopic examination. The following semen parameters: semen pH, volume, normal and abnormal morphology, sperm motility (actively and sluggishly motile), viability, (% dead and live) were evaluated.

Semen pH: This is the degree of acidity or alkalinity of semen. It was determined with the aid of a calibrated pH paper as described by Das *et al.* (2004) and Peters *et al.* (2008).

Semen volume: The semen volume specimen from individual cock strain was measured and recorded using collection tube graduated in *ml*. (Oguike *et al.,* 2000).

Semen motility: A drop of semen with the aid of micropipette was placed on a microscope slide, covered with a glass cover slipto have a uniform thickness and was viewed under the microscope (Peters *et al.*, 2008). A magnification of ×400 was used. Motility of the semen sample was expressed as a percentage of cells that are motile under their own power, proportion of normal forward movement of sperm (Mothibedi *et al*., 2016).

Sperm morphology: The size and shape of sperm is one factor that is examined as part of semen analysis to evaluate male infertility. Sperm morphology results are reported as the percentage of sperm that appear normal when semen is viewed under microscope. Normal sperm have an oval head with a long tail while abnormal sperm have head or tail defects such as large or misshapen head or a crooked or double tail.

Data analysis: Data on the semen traits from the two strains at three age periods (28, 32, and 36 weeks) were analyzed by applying multivariate analysis of the General Linear Model procedure using strain and age as fixed factors. Means were considered significant at 5 %; such means were separated using Duncan's Multiple Range Test. Pearson's correlation coefficients were estimated between strain, age and other semen traits studied. All statistical analyses were carried out using SPSS (2016).

Results and Discussion

The strain effect on semen characteristics of white and black plumage improved Nigerian local chicken (FUNAAB Alpha) is shown in Table 1. The result indicates that significant difference ($p<0.05$) exist between normal and abnormal morphology: 74.16 and 67.85; 26.25 and 32.85 for white and black plumage respectively. The semen pH and volume between the white and black plumage cocks recorded no significant difference ($p<0.05$), whereas viability was significantly higher ($p<0.05$) in white strain. Both dead sperm and sperm count were significantly ($p<0.05$) higher in the black strain. The percentage motility for actively and sluggishly motile sperm were 79.37 and 66.19; 13.12 and 16.90 for white and black plumage respectively. The result for dead sperm, normal and abnormal morphology is in agreement with the report of Ngu *et al.* (2014).

Table 1:Effect of strain on Semen characteristics of FUNAAB Alpha Chickens

ParameterStrain	White	Black
Semen pH	8.20 ± 0.044	8.19 ± 0.047
Volume	0.52 ± 0.061	0.51 ± 0.065
Viability	80.62 ± 3.217^{a}	68.81 ± 3.439^{b}
Normal morphology	74.16 ± 3.236^{a}	67.85 ± 3.460^{b}
Abnormal morphology	26.25 ± 3.590^{b}	32.85 ± 3.838^{a}
Actively motile	79.37 ± 2.818^{a}	66.19 ± 3.013^{b}
Sluggishly motile	13.12 ± 1.882^{b}	16.90 ± 2.012^{a}
Dead	16.45 ± 2.952^{b}	27.38 ± 3.156^{a}
Sperm count	61.25 ± 3.477^{b}	69.28 ± 3.717^{a}

^{ab}Means on the same row with different superscript are significantly different ($p<0.05$).

Table 2 indicates disparities observed on the semen traits at different ages, semen pH, normal morphology, actively and sluggishly motile recorded significant difference ($p<0.05$) for week 28 in contrast with weeks 32 and 36 which had no significant disparity ($p<0.05$) but numerical difference existed in the later. Waseem *et al.* (2017) found significantly higher semen volume in black and brown plumage. Apart from these, significant difference ($p<0.05$) existed in all other traits, the values for semen volume were 0.19, 0.79 and 0.55 for weeks 28, 32 and 36 respectively, with week 32 having the highest significance ($p<0.05$). The results showed that there were differences in age and strain with respect to viability, abnormal morphology, dead sperm and sperm count. These observations were in harmony with the reports of Peters *et al.* (2008), and Egbunike and Oluyemi (1979).

Table 3 indicates that all the traits evaluated were significantly influenced by the age of the cocks. Semen pH, concentration and volume, normal morphology, actively motile, and percentage live increased with age, though variation was found in sperm percentage dead and sperm count at 32 and 36 weeks of age.

Table 2: Age effect on Semen characteristics of FUNAAB Alpha breeds of white and black plumage colour

Parameter	Age			
	28 Wks	32 Wks	36 Wks	SEM
Semen pH	8.00^{b}	8.29^{a}	8.29^{a}	0.056
Volume	0.19^{c}	0.79^{a}	0.55^{b}	0.077
Viability	53.21^{b}	85.98^{a}	84.95^{a}	4.079
Normal morphology	47.50^{b}	82.09^{a}	83.43^{a}	4.103
Abnormal morphology	52.54^{a}	16.65^{c}	19.46^{a}	4.551
Actively motile	52.81^{b}	82.41^{a}	83.12^{a}	3.572
Sluggishly motile	18.08^{a}	13.34^{b}	13.61^{b}	2.386
Dead	42.81^{a}	10.93^{c}	12.00^{b}	3.743
Sperm count	59.68^{c}	66.20^{b}	69.91^{a}	4.407

^{a,b,c}Means on the same row with different superscript are significantly different ($p<0.05$)

Table 3**:** Interaction of strain and age effect on semen characteristics

Strain	Age (Wks)	N	Parameter								
			pH	Vol.	Viability	Normal Morph	Abnormal Morph	Active	Sluggish	Dead	Sperm count
White	28	8	8.00^{b}	0.29^{c}	70.00^{b}	60.00^{c}	39.37^{a}	75.62^{b}	11.87^{b}	25.62^{a}	54.37^{c}
	32	8	8.31^{a}	0.73^{a}	86.25^{a}	80.62^{b}	16.87^{c}	81.25^{a}	13.12^{a}	11.87^{b}	63.12^{b}
	36	8	8.31^{a}	0.54^{b}	85.62^{a}	81.87^{a}	22.50^{b}	81.25^{a}	14.37^{a}	11.87^{b}	66.25^{a}
	SEM		0.076	0.105	5.572	5.606	6.218	4.881	3.260	5.114	6.022
Black	28	7	8.00^{b}	0.09^{c}	36.42^{b}	35.00^{c}	65.71^{a}	30.00^{c}	24.28^{a}	60.00^{a}	65.00^{c}
	32	7	8.28^{a}	0.86^{a}	85.71^{a}	83.57^{b}	16.42^{b}	83.57^{b}	13.57^{b}	10.00^{c}	69.28^{b}
	36	7	8.28^{a}	0.56^{b}	84.28^{a}	85.00^{a}	16.42^{b}	85.00^{a}	12.85^{b}	12.14^{b}	73.57^{a}
	SEM		0.081	0.112	5.957	5.993	6.647	5.218	3.485	5.467	6.437

^{a,b,c}Means on the same column with different superscript are significantly different ($p<0.05$), N = number of cocks used

Conclusion and Recommendation

There are differences in the semen traits of the white and black plumage improved Nigerian local chicken. Such differences were more obvious during 32 and 36 weeks of age with white plumage having greater values in most of the traits, signifying that they could be of more relevance. The results of this study also show that viable semen can be achieved at 32 weeks of age in both white and black plumage. The ejaculate volume was higher in black at 32 and 36 weeks respectively. The age and strain is an essential predictor of semen viability in local chickens.

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