



Semen Characteristics and Correlation Among Three Indigenous Cock Types in the Semi Arid Zone of Nigeria

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Abstract

The study was carried out to evaluate the semen characteristics of the three indigenous cocks and correlation among semen characteristics of each cock genotype. Fifteen (15) local breeder cocks at maturity comprising three strains of indigenous cocks (5 Frizzle, 5 Normal feathered and 5 Naked Neck) were obtained from local farmers within the state and used for the experiment. They were sexually matured cocks of about 14 – 18 months of age. One year study was carried out from September 2016 to August 2017. A total of 497 semen ejaculates was collected from the cocks by the abdominal message method and were assessed for routine laboratory methods. The highest mean value of semen volume (0.45ml) was obtained in frizzle feathered cocks while the lowest mean value of (0.31ml) was obtained in the naked neck cock. Coefficient of variability was highest in semen volume and ranged from 29.77% in the normal feathered to 43.69% in the frizzle feathered cock. The lowest variable semen characteristic was pH which showed percentage variability that ranged from 4.25% in the naked neck to 6.13% in the normal feathered cock. Coefficients of variation were similar for percent non motile sperm, semen concentration and percent abnormality with values between 12.67 and 15.60%. The highest coefficient of variation for semen volume in frizzle feather cocks is indicative of the potential of this genotype to be selected for improvement. In all the genotypes negative low phenotypic correlation coefficients as well as low positive correlation coefficients exist among most semen characteristics. Significantly high negative correlation coefficient exists between individual sperm motility and percent dead sperm cells in all the genotypes. The observed high negative significant correlation between individual sperm motility and dead sperm cells in all the genotypes is expected as increase in individual sperm motility would lead to decrease in percent dead sperm cells.

Keywords: Indigenous cocks; Genotype; Semen; Characteristics and correlation.

1. Introduction

The assessment of semen quality characteristics of poultry birds gives an excellent indication of their reproductive potential and has been reported to be a major determinant of fertility and subsequent hatchability of eggs [1]. The semen of the domestic chickens according to Hafez [2], varies from a dense opaque suspension to a watery fluid with a relative high density. He further stated that the differences in semen volumes and semen concentration of the domestic cocks depends largely on the relative contribution of the various reproductive glands, the number of spermatozoa that could be obtained from a breed/strain and the extent to which the genetic potentials can be exploited. It is important to note that many researchers have worked on semen production and quality on a variety of poultry breeds and strains [3], the relationship between semen volume, sperm motility, semen concentration, pH and colour are very important since, to a large extent determine the fertility potential of the semen. Peters, *et al.* [4] noted that there were differences in strain with respect to semen volume, concentration, and motility, active and sluggish spermatozoa. The differences in frizzled feathered, normal feathered exotic cocks semen volume and concentrations could be attributed to differences in strains, genetic backgrounds and environmental differences [2]. The aim of this study is to evaluate semen characteristics and the relationships among the three genotypes of indigenous cock types in semi-arid zone of Nigeria.

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2. Materials and Methods

2.1. Experimental Site and Management of Birds

The study was conducted at the Teaching and Research Farm of the Department of Animal Science, University of Maiduguri, Borno State. Maiduguri is situated within the semi-arid region of Nigeria which lies within the Sahel zone of West Africa. Borno state lies within latitude 100° and 140° N and longitude 110° 30' and 140° 45' E [5]. Maiduguri is characterized by two distinct seasons, the rainy and the dry seasons. The peak of dry and hot season is between April and May which characterized with bright sunny days in which the atmospheric temperature fluctuates between 40 to 50 °C most of the time. During the rainy (wet) season, the temperature may drop to about 30°C. The peak of rainfall is in August where precipitation may exceed 198.6mm [6].

2.2. Experimental Animals

Fifteen (15) local breeder cocks at maturity comprising three strains of indigenous cocks (5 Frizzle, 5 Normal feathered and 5 Naked Neck) were obtained from local farmers within the state and used for the experiment. They were sexually matured cocks of about 14 – 18 months of age. The experimental birds were acclimatized for two weeks during which they were monitored and screened. Each cock was tagged for ease of identification. The study was conducted during the rainy and dry seasons. The cocks were housed individually in 1.0 ft conventional battery cage, and were fed Top feeds® growers mash from premier feed mills limited Nigerian throughout the experimental period. The grower mash contained 18% crude protein and Metabolisable energy 2900 kcal/kg. Feed and water were given fresh and in *ad-libitum* throughout the study period. All birds were trained to produce semen prior to actual semen collection. This was considered necessary not only for effective semen collection but also to make the birds familiar with the semen collector. Semen samples collected from the birds were accomplished by abdominal massage technique [7]. The cloaca of each bird was massaged by the application of a slight finger to generate pressure to allow the papillae release the semen. This was then milked down into a graduated collection tube. Semen samples collected were subjected to microscopic examination and physical evaluation.

2.3. Semen Collection and Evaluation

A total of 497 semen ejaculates was collected from the cocks by the abdominal message technique as described by Etches [7]. Semen from all cocks were collected between 08:00 am and 10:00 am during each of the season throughout the experimental period. Each bird responded to massage by partial aversion of the cloaca, and semen was collected from the ventral lip of the vent in a tube maintained at ±38-40°C. Individual ejaculates were collected into 1.8 ml graduated collection tube to record the volume of the semen per ejaculate. During collection the semen tube was maintained at 38-40°C in a thermo flask. The sperm was analyzed for motility following each semen collection; the sample was visually assessed for volume using the calibrations on the collecting vials. Volume was record to the nearest 0.1 ml. Thereafter, sperm motility was immediately evaluated. Motility was expressed as the percentage of motile sperm with moderate to rapid progressive movement [8]. The semen collected was subject to microscopic examinations and physical evaluations. A drop of undiluted semen was placed on a glass slide, cover slipped and examined under the field microscope at x 100 magnification. The vial was immersed into water flask containing water maintained at 40°C for further semen evaluation. Semen colour was visually observed from a transparent collecting vials and expressed as creamy, milky or watery, and scored as 3, 2 or 1, respectively as described by kabir, *et al.* [9]. The semen pH was obtained using the pH meter strip. Colour change on the strip will be read using the pH meter (Chemo craft®) as indicated by the manufacturer.

Percent dead spermatozoa and the sperm abnormalities were obtained using stained slides from each of the semen samples. The stained slides were prepared using the eosin-nigrosin vital technique as described by Sekoni, *et al.* [10]. A drop of the semen sample was placed on one end of the slide and a drop of the eosin-nigrosin vital stain was added and both was gently mixed. The mixture was then collected using the edge of a clean dry slide, and a smear made on a fresh slide. Then the stained slide was left to dry. The percentage dead sperm cell was calculated from the stained slides as described by Estes, *et al.* [11]. The slide was viewed under the light microscope at x 400 magnification and 100 sperm cells were counted per slide for both live and dead spermatozoa. The dead sperm cells stained with the eosin dye while the live cells repelled the stain. This was repeated to ensure accuracy and the average was taken. Sperm abnormalities were studied from the stain slides under the light microscope at x 1000 magnification using the oil immersion. Concentration of the spermatozoa was determined as described by Rekwot, *et al.* [12]. The cells were counted using the red blood cell counting chamber of the haemocytometer, diagonally from top left to right bottom in 5 large squares from the 25 large squares. The concentration of sperm per volume was found using the formula:

$$C = 50,000 \times N \times D$$

Where C = concentration of semen per volume (ml), N= Number of spermatozoa counted,
D = Dilution rate.

2.4. Experimental Design and Statistical Analysis

The experiment involved completely randomized design. Data were analyzed using Descriptive statistics and Pearson Correlation Coefficients were computed using SPSS software version 20.

3. Results

The results of descriptive statistics of semen characteristics of the three indigenous cocks are shown in Table 1. The highest mean value of semen volume (0.45ml) was observed in frizzle feathered cocks while the lowest mean

value of (0.31ml) was observed in the naked neck cocks. Coefficient of variation of semen volume showed highest value 29.77% followed by the normal feathered 43.69% than the frizzle feathered cocks. The lowest variable for semen characteristics was pH which showed percentage variability that ranged from 4.25% in the naked neck to 6.13% in the normal feathered cock. Semen volume showed high coefficient of variation between the three strain. Normal feather, frizzle feather and naked neck cock with CV 29.77, 43.69 and 37.92 respectively.

Table-1. Descriptive Statistics of Semen Characteristics of Three Indigenous Cocks

Genotype/parameters	Minimum	Maximum	Range	Mean	Variance	SEM	CV
N/F semen							
Volume(ml)	0.20	0.50	0.30	0.33	0.01	0.03	29.77
Colour (score)	1.50	2.60	1.10	1.96	0.09	0.09	15.07
pH	6.50	7.80	1.30	7.24	0.11	0.15	6.13
Motility (%)	44.75	65.25	20.75	58.06	45.69	2.25	11.64
Dead sperm (%)	34.25	55.25	21.00	42.16	43.26	2.19	15.60
Conc(x10 ⁹ /ml)	2.96	4.29	1.33	3.64	0.24	0.17	13.57
Abnorm (%)	18.6	26.8	8.20	22.98	8.48	0.97	12.67
FF semen							
Volume(ml)	0.28	0.91	0.63	0.45	0.04	0.07	43.69
Colour(score)	1.60	2.25	0.65	1.98	0.06	0.08s	12.37
pH	6.80	7.75	0.95	7.2	0.12	0.19	4.88
Motility (%)	51.00	66.60	15.60	61.28	28.11	1.77	8.65
Dead sperm (%)	31.40	49.00	17.60	38.49	31.21	1.86	14.51
Conc(x10 ⁹ /ml)	2.90	4.48	1.58	3.81	0.39	0.18	14.35
Abnorm (%)	17.00	26.20	9.20	22.17	9.45	1.02	13.87
NA semen							
Volume(ml)	0.10	0.50	0.40	0.31	0.01	0.04	37.92
Colour (score)	1.80	2.50	0.70	2.21	0.06	0.25	11.58
pH	6.60	7.65	1.05	7.32	0.01	0.10	4.25
Motility(%)	31.00	54.00	23.00	60.02	31.40	1.87	9.34
Dead sperm(%)	39.00	54.00	23.00	39.98	31.40	1.87	14.02
Conc(x10 ⁹ /ml)	3.21	5.00	1.79	3.76	3.21	1.17	13.18
Abnorm (%)	15.60	23.50	7.90	20.82	15.60	0.99	14.38

NF= normal feather cock, FF= frizzle feather cock, NA= naked neck cock, conc= semen concentration, Abnorm = percent sperm abnormality.

3.1. Correlation Coefficients Among Semen Characteristics

The Pearson correlation coefficients among the semen characteristics of the normal ,frizzle, and naked neck cocks are presented in Table 2, 3 and 4 respectively.

Most of the semen characteristics of the normal feathered cock showed non significant negative and low correlation among themselves while some had positive non significant low correlation. Semen concentration had significant ($p < 0.01$) negative correlation ($r = -0.451$) with semen pH . Similarly individual Sperm motility negatively correlates with dead sperm cells with a significant high value of ($r = -0.999$). Abnormal sperms correlated negatively with semen volume, colour, concentration and pH, which values were very low. However, a significant moderates correlation was observed between sperm abnormality and dead sperm cells.

3.2. Correlations Among semen attributes of the frizzled cocks

Similar trends of negative low correlation coefficients as well as positive but low correlation coefficient are observed among semen characteristics of the frizzled cocks as observed in the normal feathered cocks. Semen pH had low and negative non significant correlation with individual sperm motility and semen concentration. Also as in the normal feathered cock, individual sperm motility had a high negative significant correlation ($r = -0.985$) with dead sperm cells.

3.3. Correlation Among Semen Characteristics Of Naked Neck Cocks

In the naked neck cocks only individual sperm motility, demonstrated high negative significant ($p < 0.01$) correlation ($r = -0.999$) with dead sperm cells. All the other observed correlation coefficients are either very low, negative and non significant or very low positive and non significant.

Table-2. Pearson Correlation Coefficient among Semen Characteristics of Normal Feathered Cocks in Semi Arid Zone of Nigeria

	Volume	Colour	pH	Mot	Dsc	Conc	Abnorm
Volume	1						
Colour	0.094	1					
pH	-0.035	-0.011	1				
Mot	0.119	-0.047	-0.114	1			
Dsc	-0.118	0.045	0.125	-0.999**	1		
Conc	0.320	0.126	-0.451**	0.233	-0.235	1	
Abnorm	-0.026	-0.050	-0.050	0.495	-0.495*	0.190	1

Mot= percent sperm motility, Dsc = percent dead sperm cell, conc= semen Concentration, abnorm = percent sperm abnormality. * = $p > 0.05$ and ** = $p > 0.01$

Table-3. Pearson Correlation Coefficient among Semen Characteristics of Frizzle Feathered Cocks in Semi Arid Zone of Nigeria

	Volume	Colour	Ph	Mot	Dsc	Conc	Abnorm
Volume	1						
Colour	-0.045	1					
pH	-0.045	0.144	1				
Mot	0.067	0.062	-0.334	1			
Dsc	0.004	-0.050	0.338	-0.985**	1		
Conc	0.310	0.039	-0.338	0.020	-0.264	1	
Abnor	0.092	0.30	0.227	0.204	0.227	0.070	-1

Mot= percent sperm motility, Dsc = percent dead sperm cell, conc = semen Concentration, abnorm = percent sperm abnormality.**= p> 0.01

Table-4. Pearson Correlation Coefficient among Semen Characteristics of Naked neck Cocks in Semi Arid Zone of Nigeria

	Volume	Colour	pH	Mot	Dsc	Conc	Abnorm
Volume	1						
Colour	0.275	1					
pH	-0.144	-0.358	1				
Mot	0.111	0.192	-0.255	1			
Dsc	-0.109	0.313	0.264	-0.999**	1		
Conc	0.271	0.213	-0.320	-0.150	-0.150	1	
Abnor	0.213	0.213	-0.360	0.265	-0.254	0.172	1

Mot= percent sperm motility, Dsc = percent dead sperm cell, conc = semen Concentration, abnorm = percent sperm abnormality.**= p> 0.01

4. Discussion

The mean semen volume obtained from the present study agrees fairly well with the average obtained by Bah, *et al.* [13] in Sahel cocks. However, the highest mean semen volume obtained in frizzle feathered cock in the present study did not agree with the findings of Peters, *et al.* [4] Ajayi, *et al.* [14] and Ajayi, *et al.* [15] who reported that the naked neck cock produced the highest mean semen volume. This may be due to environmental differences since the earlier works were carried out in the South western parts of the country, while the present work was done in the semi arid northern part of the country. It may also indicate genotype by environmental interaction. The slightly acidic to slightly alkaline semen obtained in the cocks studied are similar to the findings of Uchechukwu, *et al.* [16] and Tuncer, *et al.* [17] who reported a pH of 7.4 ± 0.1 for Erbro cocks and 7.5 ± 0.1 for Denizli cocks. The mean pH of 7.24 obtained in the present study was higher than values obtained by Peters, *et al.* [4] who reported a ranged of 7.01 ± 0.01 to 7.04 ± 0.02 for some strain of chickens. It is important to ensure proper pH as it helps in sustaining the viability of spermatozoa. Earlier experiments have indicated that chicken spermatozoa can tolerate a pH range of 6.0 to 8.0 [18]. The semen concentrations of all the genotype were within the range reported by Peters, *et al.* [4] ($3.11 - 4.21 \times 10^9$ /ml) but higher than the values obtained by Bah, *et al.* [13] who gave values of 2.26×10^9 /ml. The highest coefficient of variation for semen volume in frizzle feather cocks is indicative of the potential of this genotype to be selected for improvement in semen volume. The mean value of sperm motility obtained in the present study is lower than the values obtained by Selvan [19] who gave a range of 81.71- 87.6% in a study on Rock fowls. Differences in sperm motility across breeders have been reported to be due to their genetic tendencies [3]. The average semen colour score obtained in this study is comparatively lower than the average score of 2.96 ± 0.11 reported by kabir, *et al.* [9] in Rhode Island Red and White breeder cocks. This may be due to breed differences in semen density that may affect variation in semen appearance. The relationship between semen volume and semen pH, semen colour, sperm motility, semen concentration and percent sperm abnormality are very important since they, to some large extent determine the fertility of the semen. Positive, low and nonsignificant correlations as observed between semen volume and semen concentration in the present study is consistent with the report of Uchechukwu, *et al.* [16]. The positive but nonsignificant correlation may indicate that increase in semen volume may not necessarily translate to higher semen concentration. This submission agrees with Peters, *et al.* [4] but contradicts the findings of Bah, *et al.* [13] who obtained negative correlation between semen volume and semen concentration. The significant but low correlation that exists between semen volume and percent sperm motility may indicate that increase in semen volume may lead to increase in percent motility. The negative and significant relationship between semen pH and semen concentration, in the present findings with did not agree with the observation of Donoghue and Wishart [20] and Uchechukwu, *et al.* [16] who found positive correlation between semen pH and semen concentration. This in the presents study may indicate that any increase in semen concentration may lead to decrease in semen pH and vice, versa. Positive and significant correlation that exist between sperm motility and percent abnormality as well as between sperm motility and dead sperm cells concord with the findings of Bah, *et al.* [13] that percentage of abnormal spermatozoa decreases as the number of motile sperm increases and vice versa. The observed high negative significant correlation between individual sperm motility and dead sperm cells in all the genotypes is expected as increase in individual sperm motility would lead to decrease in percent dead sperm cells.

5. Conclusion

The semen characteristics of three indigenous types of breeders cocks viz normal feathered naked neck and frizzled feathered in the semi arid region of Nigeria did not differ much from those reported in other breeds of cocks.

However, the frizzle and naked neck cocks should be used for selection in this region because of their higher values in semen concentrations.

In all the genotypes negative low phenotypic correlation coefficients as well as low positive correlation coefficients exist among most semen characteristics. Significantly high negative correlation coefficient exists between individual sperm motility and percent dead sperm cells in all the genotype. The observed high negative significant correlation between individual sperm motility and dead sperm cells in all the genotypes is expected as increase in individual sperm motility would lead to decrease in percent dead sperm cells.

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