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RELATIONSHIP BETWEEN BODY WEIGHT AND SEMEN QUALITY TRAITS OF PURE AND IMPROVED INDIGENOUS NIGERIAN COCKS

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Abstract
The body weight and semen quality traits of pure and improved indigenous Nigerian cocks were studied. A total of 100 sexually matured cocks, including 40 normal feather genotype (NM), 20 frizzle feather genotype (FZ), and 20 naked necks from pure and improved indigenous Nigerian chickens, as well as 20 normal feather genotype (NM) from local chickens, were sampled. One-way analysis of variance was used to evaluate data on body weight and semen characteristics, and mean differences were separated using Tukey. Genotype had a significant ($p<0.05$) effect on body weight and some semen quality traits. The frizzle feather genotype had the highest mean semen membrane (74.40±3.71) compared to the naked neck (73.30±6.64) and normal feathered genotype (71.10±5.64). Abnormal sperm cells were found mostly in frizzle genotypes (3.70±0.66), followed by naked neck (3.30±0.47) and normal feathered genotype (3.23±0.73). However, naked neck chickens consistently had superior body weight (2561±49.26) than frizzle (2442±84.20) and Normal feathered genotype (2472±63.74) which were statistically similar. Pearson correlation revealed that body weight and genotype had significant ($p<0.05$) and positive relationships with some semen traits. The information on genotype effects and range of genetic relationship between body weight and semen traits reveals some levels of associations; thus, these traits can be included in a selection index to achieve positive genetic progress.
Keywords; Body weight; semen quality traits; indigenous Nigerian cocks.

Introduction
Semen, an essential component of reproduction, comprises sperm cells capable of fertilizing the female's eggs. The qualities and evaluation of sperm are vital markers of a breeding cock's reproductive potential (Peters *et al*., 2008). The quality of the semen produced by poultry birds (cocks) is believed to determine their reproductive potential (Ajayi, 2011). The evaluation of semen quality in poultry breeding is central to the selection of superior breeding males for improved reproductive performance. Studies have shown that breed and strain have a significant impact on semen quality and quantity (Peters *et al*., 2008; Ajayi, *et al*., 2011). The study seeks to examine the relationship between body weight and semen quality traits of pure and improved indigenous Nigerian cocks.

Materials and Methods
This research was conducted at the Poultry Breeding Unit of the Directorate of the university farms of the Federal University of Agriculture, Abeokuta, located within latitude 7◦10'N and a longitude 3◦2'E of Southwestern Nigeria. The experimental cocks comprised 40 Normal feathers (NM), 20 Frizzle feathers (FZ) and 20 naked necks from pure and improved Nigerian indigenous chicken and 20 normal feathers (NM) of local chickens.

Semen collection and Evaluation
Semen was collected twice a week by rectal massage. Ejaculate from each cockerel was collected into15ml Eppendorf tube (falcon® 352099, USA). Collection tubes were maintained at 40˚c in a Thermo flask during collection periods to prevent cold shock. Ejaculates were evaluated for colour, motility, abnormality, membrane, livability and Acrosome. Sperm motility was determined as described by Bearden and Fuquay (1997). The semen samples were thawed briefly in Clifton Water bath at 37˚C and assessed for sperm motility using Celeston PentaView microscope (LCD-44348 by RoHS, China) at 400 x magnification. A 5 µL sample of semen was placed directly on a warmed microscope slide and overlaid with a 22 x 22 mm slipcover. Each

semen sample was measured using different slides to observe progressively motile spermatozoa. 50 µL of each thawed semen sample was added to 500 µL formalin citrate solution (96 mL 2.9% sodium citrate with 4 mL 37% formaldehyde) and mixed to assess acrosome integrity using a digital microscope (400 x magnification). Hypo-osmotic swelling test (HOST) was used to determine sperm membrane integrity. Eosin-nigrosin stain was applied to determine live sperm and the percentage of morphologically abnormal spermatozoa.

Statistical Analysis

Data on semen quality traits and body weight were analyzed using a one-way analysis of variance (ANOVA) to determine the mean among genotypes and the differences between the means of the genotype were separated using Tukey; SAS, Inc. (2008). General Linear Model (G.L.M) was used;

Yij= µ + Gį + Eij. Where; Yij= Observation of the ith, µ= Population mean, Gi= fixed effect of ith genotype (i= Frizzle feather, Naked neck, Normal feather and local chicken) and Eij= Residual errors. The operational model of Pearson correlation is as follows;

$$r = \frac{\sum XiYi}{\sqrt{\sum X^2i \sum Y^2i}}$$

Where; r = Pearson's product-moment correlation coefficient, Xi = the 1nd random variable of the ith bodyweight and Yi = the 2nd random variable of the ith Bwt or semen quality traits.

Results

Effect of genotype on semen quality traits

Table 1 shows genotype effect on semen quality traits. Genotype significantly ($p<0.05$) affects semen membrane and abnormality but not significant ($p>0.05$) for semen motility, acrosome and livability. Normal feather genotype had the highest mean value of (74.95±5.64) when compared to other genotypes as well as the pure Nigerian local chicken (69.80±4.10) but not significantly different from Frizzle feather (74.40±3.71) and Naked genotype (73.3. ±6.84). However, the naked neck chicken was not significantly different from the pure Nigerian local chicken. Semen abnormality as affected by genotype did not follow the pattern as semen membrane, although the three (3) genotypes of the improved Nigeria indigenous chicken (Naked neck, normal feather and Frizzle feather) were not significantly different (3.30±.047, 3.23±0.73, 3.70±0.66 but better than pure Nigerian local chicken (3.00±0.73). However, the Frizzled feather genotype had the highest mean value of semen abnormality and the least observed in the naked neck genotype. Semen motility, acrosome and livability were not significant for all chicken genotypes. Nevertheless, the normal feather chicken genotype consistently had the highest mean values, while the least was observed in the pure Nigerian local chicken. The naked neck genotype, had the highest body weight (2561±49.26) when compared to the other genotype while the least was observed in the pure Nigerian local chicken (1374±44.79g). However, the frizzled feather chicken genotype (2442±84.20) and normal feather chickens (2472±63.74) were statistically similar.

Table 1: Genotype effect on Semen quality traits of Pure and improved Nigerian indigenous chickens (LSM±S.E.M)

Genotype	N	Body Weight	Motility	Acrosome	Membrane	Livability	Abnormality
FZ	20	2442±84.20^{b}	88.00±6.96	73.00±4.61	74.40±3.71^{a}	82.50±7.16	3.70±0.66^{a}
NK	20	2561±49.26^{a}	88.00±6.76	74.30±5.20	73.30±6.84^{ab}	82.0±6.96	3.30±0.47^{a}
NM	40	2472±63.74^{b}	88.00±7.23	74.80±5.72	71.10±5.64^{a}	83.75±7.05	3.23±0.73^{a}
LC	20	1374±44.79^{bc}	88.00±7.67	71.40±6.56	69.80±4.10^{b}	81.50±5.87	3.00±0.73^{b}

P<0.05^{abc} means on the same row with the same letter are

not significantly different, **N**: number of samples, **NM**: Normal feather, **NK**: Naked neck, **FZ**: frizzle feather chicken and **LC**: local chicken.

Pearson correlation of some Semen characteristics among chicken genotype.

Table 2 shows the Pearson correlation coefficient of semen characteristics and genotypes. The coefficient of correlation between semen characteristics and chicken genotype ranges from low to medium to high, within each genotype, having both negative and positive correlation. The correlation coefficient of semen characteristics for the frizzle feathered genotype was observed to be significant ($p<0.05$) however, negative correlations was observed in semen characteristics which involve semen abnormality and semen livability (r= -0.37), semen abnormality and semen acrosome (r=-0.31), semen abnormality and semen membrane (r= -0.04) but positively correlated with semen livability. In addition, body weight was positively correlated with most semen characteristics evaluated; body weight and semen motility (r=0.03), body weight and semen acrosome (r=0.56) body weight and semen membrane (r=0.03), which is the lowest correlation. Bodyweight and semen livability (r= -0.09), except for correlation between body weight and semen abnormality (r= -0.19). Semen membrane negatively correlated with both semen motility (r= -0.17) and semen acrosome (r= -0.35), while the semen acrosome was positively correlated with semen motility (r= 0.10), though not statistically significant ($p>0.05$). Semen livability was positively correlated with semen acrosome (r= 0.37) but negatively correlated with both semen motility (r= -0.11) and semen membrane (r= -0.75) was significant. The coefficient of correlation of semen traits found within the normal feather genotype was generally low, both positively and negatively correlated. However only correlation involving semen abnormality and body weight were significant ($p<0.05$). Correlation of semen abnormality and semen motility (r= 0.33) as well as, semen abnormality and semen membrane (r=0.11) were positively correlated, while semen abnormality and semen acrosome (r= -0.26) were negatively correlated.

Table 2: Pearson correlation among the genotype of pure and improved Nigerian indigenous chicken

Frizzle (n=20)	**Mo**	**Ac**	**Me**	**Li**	**Ab**	**Bwt**
Mo	1.0	0.10	-0.17	-0.11	-0.37	0.03
Ac		1.0	-0.35	0.37	-0.31	0.56
Me			1.0	-0.75	-0.04	0.03
Li				1.0	0.17	0.09
Ab					1.0	-0.19
Bwt						1.0
Normal (n=40)						
Mo	1.0	0.23	0.15	-0.05	0.33	-0.21
Ac		1.0	0.21	-0.27	-0.26	-0.17
Me			1.0	0.09	0.11	0.03
Li				1.0	-0.12	0.25
Ab					1.0	-0.17
Bwt						1.0
Naked neck (n=20)						
Mo	1.0	0.9	-0.06	-0.03	0.04	0.17
Ac		1.0	-0.03	-0.11	-0.04	-0.22
Me			1.0	0.21	-0.23	-0.34
Li				1.0	-0.03	0.44
Ab					1.0	0.66
Bwt						1.0
Local (n=20)						

Mo	1.0	0.06	-0.21	-0.16	0.09	0.16
Ac		1.0	-0.11	-0.49	0.33	-0.34
Me			1.0	0.76	-0.71	-0.31
Li				1.0	-0.62	0.23
Ab					1.0	-0.13
Bwt						1.0

($p<0.05$)=significance, **Me**: Membrane, **Li**: livability, **Mo**: Motility, **Ab**: Abnormality, **Ac**: Acrosome integrity, **Bwt**: Body weight.

Pearson correlation between Body weight and some Semen characteristics of pure and improved Nigerian indigenous chickens

Pearson correlation between Body weight and Semen characteristics of pure and improved Nigerian indigenous chickens is shown in table 3. The correlation analysis showed that the association between bodyweight was not significant ($p>0.05$) for all the semen characteristics evaluated. The coefficient of correlation between semen characteristics was generally very low with both positive and negative values ranging from 0.10 to 0.31. However, positive correlations was observed between semen acrosome and semen motility (r=0.14), semen membrane and semen acrosome (r=0.09), semen livability and semen membrane (r=0.12), semen abnormality and semen motility (r=0.10), and the correlation between body weight and semen acrosome (r=0.20), semen membrane (r=0.31), semen livability (r=0.11), and semen abnormality (r=0.19) respectively.

Table 3: Pearson correlation between Body weight and some Semen characteristics.

(N=100)	Motility	Acrosome	Membrane	Livability	Abnormality	Body weight
Motility	1.0	0.14	-0.01	-0.08	0.10	-0.01
Acrosome		1.0	0.09	-0.14	-0.07	0.20
Membrane			1.0	0.12	-0.03	0.31
Livability				1.0	-0.12	0.11
Abnormality					1.0	0.19
Body weight						1.0

Discussion

The reproductive potential of poultry birds can be determined by the quality of the semen it produces, Peters et al. (2008). The observed difference in semen quality with genotype in this study agrees with the findings of Peters *et al.* (2008) and Ajayi, *et al.* (2011) who reported no variation from semen motility with frizzled neck, naked neck, normal feather and local chicken. Differences in strain in terms of motility of frizzle, normal feather and naked neck may be due to their different genetic background, their natural tendencies, and environmental factors. Also, Tuncer *et al.* (2008) have indicated 83.2% sperm motility in the White Leghorn line and 77.6% in New Hampshire cocks.

Omeje and Marine (1990), observed that significant differences affect body sizes and semen characteristics of cocks. The local chicken which is a light bodyweight cock had a lower live sperm this was in agreement with Holcman *et al*. (1993) who opined that cocks with better bodyweight might have improved semen production. Further, Adeyemo *et al*. (2007) buttressed this results that birds characterized by heavier body weight and larger testes produce more spermatozoa during spermatogenesis and thus yield bigger semen volume.

The correlation coefficient indicates the strength of a linear relationship between two traits and thus provides useful information about the traits involved for breeding and improvement plans. The moderate to a high and positive range of genetic correlation between body weight and some semen quality traits found in this present study indicate a degree of favorable relationships among body weight and semen traits with a higher correlation coefficient. This further implies these traits can be included in a selection process for better genetic progress.

Conclusion.

Genotype exhibits a positive influence on some semen quality traits including; semen membrane, semen abnormality except semen motility, acrosome and semen livability. Bodyweight shows a positive association with livability, abnormality, acrosome, semen membrane and livability. The information on genotype effect and genetic relationship between body weight and semen traits indicates some level of associations hence, such traits can be collectively exploited to achieve positive genetic progress.

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