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COMPARATIVE STUDIES OF SEMEN AND HAEMATOLOGY QUALITY OF NIGERIAN INDIGENOUS AND EXOTIC CHICKEN BREEDS IN THE HUMID TROPICAL ZONE OF NIGERIA

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ABSTRACT
The study was conducted to determine the quality and haematological parameter of three genotypes of the Nigerian indigenous chicken and two breeds of exotic chicken. A total of twenty (20) cocks, belonging to five sire strains comprising of three Nigerian indigenous chicken (Naked Necked, Frizzled and Normal feathered) and 2 exotic breeds (Isa brown and Harco) were used for the study. Semen samples were collected from the cocks by abdominal massage and examined for parameters such as semen volume, colour, viscosity, pH, total sperm count, mortality, red blood cell (RBC) and pus cell. Blood samples were also collected from the birds and examined for haematological parameters such as Packed Cell Volume (PVC), Haemoglobin (HB), White Blood Cell (WBC), Red Blood Cell (RBC), Mean Corpuscular Haemoglobin Concentration (MCHC), Mean Corpuscular Haemoglobin (MCH), Mean Corpuscular Volume (MCV), Neutrophil (N) and Lymphocyte (L). Strain effect significantly ($P< 0.05$) affected semen volume, total sperm count but not ($P> 0.05$) pH and viscosity. Naked Necked cocks had the highest semen volume of 0.5ml while normal feathered had the least of 0.20ml. Also, all breeds had pH of 8.00 respectively. Contaminants such as RBC and pus cells were also observed in the semen. Semen colour of the birds varied from milky to milky brown. Progression of semen varied from poor to good in all breeds. Haematological parameters such as PCV, HB, WBC, RBC, MCHC and MCH were significantly ($P<0.05$) different among the five strains of chicken but no significant difference ($P>0.05$) for platelet, MVC, N and L in all the strains. It was concluded that genetic variation existed on semen quality and haematological parameter in cocks used for the study and that the indigenous cocks had comparable results with the exotic breeds and can therefore be included in artificial insemination (A.I) programme for genetic improvement as contributors of rare genes.

KEYWORDS: Semen, haematology, Nigerian indigenous, chicken

INTRODUCTION

The poultry industry is one of the fastest growing segments of the agric sub- sector in Nigeria. Rapid human population and low protein intake are some of the major problems facing developing countries like Nigeria. Poultry products (meat and eggs) present the most affordable source to migrate the problems of protein malnutrition in Nigeria (Akinokun, 1990). The Nigerian local chicken which consists between 80 to 90 percent of the local population have small body size, poor growth, small egg size and poor reproductive performance (Oguike *et al.*, 2000). These characteristics makes them an undesirable stock in the economic stock market (Oguike *et al*., 2000) but can easily adapt to rural environment, survive on little or no food supplement and adjust to fluctuation in feed availability while the exotic breeds are mostly found in commercial production and are almost exclusively intensively managed. The Nigerian indigenous chicken breeds have been reported to have many advantageous gene complexes that could be harnessed in the development of meat or egg type chicken suitable for use in the tropics (Machebe and Ezekwe, 2004). Among these major genes are the Naked necked, Frizzled and Normal feathered. According to Ibe (1998) the Frizzled and Naked neck genes are tolerant to heat stress, disease resistance and possess increased productive capacity. The assessment of semen quality characteristics of poultry birds gives an excellent indicator of their reproductive potential. Assessment of semen quality characteristics of poultry has been reported to be a major determinant of fertility and subsequent hatchability of eggs (Peters *et al*., 2004). Fertility and hatchability on the other hand are the major determinant of profitability in the hatchery enterprise. Adedokun and Sonaiya (2001) stated that, although hens and cocks are genetically considered to be equal partners in mating, the cock's reproductive performance has a major impact on the reproductive efficiency of poultry operations. However, just like the males of many animal species, the fertilizing potential of chicken varies even within flock. Breeds and strains have been observed to significantly affect semen quality of the domestic fowl (Bah *et al*., 2001; Tuncer *et al*, 2006; Peter *et al*, 2008). This variation in male breeder quality has been attributed to management environment, nutrition, genetic make-up or the combined effect of these factors (Adedokun and Sonaiya, 2001). Also, haematological analysis can be a diagnostic tool to assess the health status of an individual and/or a flock. Haematological parameters provide valuable information on the immune status of animals (Kral and Suchy, 2000). Haematological parameters of different chickens have been evaluated by different workers (Oladele *et al.*, 2001; Ihekwumere *et al*., 2001 and Adejumo, 2004). Low values of PCV and HB have been attributed to poor nutrition especially protein deficiency

and low RBC (erythrocyte) values attributed to system of management (Ikhimioya *et al.*, 2002). Artificial insemination in poultry is a viable alternative for efficient and maximum production of chicks for meat and egg. Therefore, for good results in artificial insemination, the quality of semen should be ensured (Alkan *et al*, 2002). This study compared the semen quality of the Nigerian indigenous chicken with that of the two exotic breeds and examined the haematological parameters of the Nigerian indigenous chicken and two exotic breeds of chicken in the humid tropical zone of Nigeria to provide information needed for improvement of native chicken in Nigeria.

MATERIALS & METHODS

The study was conducted at the poultry unit of the Faculty of Agriculture, University of Port Harcourt Teaching and Research farm, Choba, Port Harcourt. A total of twenty (20) cocks of different strains of the Nigerian indigenous chicken: Normal feathered, Frizzled feathered and Naked neck and two (2) exotic breeds: Isa brown and Harco were used for the study. They were sexually matured cocks of about 14 – 18 months of age. All birds were housed in a deep litter system. 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 collection from the birds was accomplished by abdominal massage technique (Lake, 1962). The cloaca of birds was massage with 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. Observation were made and records taken for semen volume, semen pH, progression, motility, total sperm count, semen colour (appearance), pus cells and red blood cell. Semen volume for cocks was read off the collection graduated tube in ml. Colour (appearance) was assessed visually. Viscosity was also accomplished by visual recognition. The pH of the semen was determined with the aid of a calibrated pH meter. Total sperm count is the product of the semen volume and the sperm concentration. An improve neubauer haemocytometer was used to determine the total sperm count. 19 drops of formal saline was mixed with 1m of semen at a dilution rate of 1 in 20. A drop of the diluted semen was placed on the haemocytometer with the aid of a micro-pipette and was viewed under a microscope at a magnification of X400. The spermatozoa head that falls within the sub-divided smaller square at the four edges and the center of the haemocytometer were counted. For mobility, a drop of the semen was placed on a slide with the aid of a micro-pipette, which was then covered with a glass cover slip to spread the semen in order to have a uniform thickness. It was then placed on a microscope at a magnification of X400 for examination. Mobility was expressed as the percentage of cells that are under their own power. Blood samples were collected from the wing vein of the birds using a 3ml disposable syringe and directly transferred into a labeled test tube containing EDTA (Ethylenediamine tetra acetic acid) anticoagulant. It was immediately used for measuring the haematological parameters such as red blood cells (RBC), white blood cells (WBC), haemoglobin (HB), packed cell volume (PVC), platelet, mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), neutrophil (N) and lymphocytes (L)

Statistical Analysis

The data collected for both semen and blood were subjected to one way analysis of variance (ANOVA) using SPSS statistical package version 18. Separation of significant means was done using the Duncan's Multiple Range Test (Steel and Torrie, 1980).

RESULTS

Table 1 shows the comparison of semen quality of indigenous and two exotic breeds of chicken used for this study. The summary of the analysis of variance (ANOVA) from the table revealed significant differences ($P<0.05$) observed in viscosity and pH.

TABLE 1. Comparison of semen quality in indigenous and two exotic breeds

Breeds	Volume (ml)	Viscosity	pH	Sperm count ($x10^6$/ml)
Harco	0.37^{ab}	Normal	8.0	33.0^{c}
Isa brown	0.30^{ab}	Normal	8.0	10.00^{c}
Frizzled feather	0.20^{b}	Normal	8.0	5.00^{c}
Normal feather	0.20^{b}	Normal	8.0	400.00^{b}
Naked neck	0.50^{a}	-	-	800.00^{a}

a,b,c, means within the same column carrying different letters differ significantly ($p<0.05$)

The least square mean as represented in the table revealed that Naked neck had the highest semen volume. This was followed by Harco, Isa brown, Frizzled feathered and Normal feathered cocks with corresponding values of 0.58ml, 0.30ml, 0.20ml, and 0.20ml respectively. For sperm count, Naked neck has the highest count. This was followed by Normal feathered, Harco, Isa brown and Frizzled feathered cocks with corresponding mean values of 800.00(10^6/ml), 33.30 ($x10^6$/ml), 10.00(10^6/ml) and 5.00($x10^6$/ml) respectively. The viscosity for all breeds was normal. Table 1 also revealed that all breeds had a pH of (8.0), indicating that the pH is slightly alkaline. Table 2 shows the comparison of semen colour, mortality (progression, active, sluggish and dead cell), pus cells and RBC amongst the various breeds used in the study. The colour was 100% milky brown for all breeds except for Harco that had 66.7% milky brown and Naked neck that had 50% milky brown. The progression was 100% poor for Isa brown, Frizzled feathered and Naked neck, except for Harco that had 13.3% poor and 66.6% good.

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TABLE 2: Comparison of semen colour, mortality, pus and red blood cells in indigenous and exotic breeds of chickens

Breeds	Colour (app)	%	Progression	%	Active	%	Sluggish	%	Dead cell	%	Pus cell	%	RBC	%
Harco	Milky Brown	66.7	Poor	33.3	30.00	33.33	10.00	33.33	10.00	33.33	1-2	66.7	-	66.7
	Milky	33.33	good	66.7	40.00	33.33	20.00	33.33	40.00	66.7	4-5	33.33	++	33.3
	-	-	-	-	80.00	33.33	30.30	-	-	-	-	-	-	-
Isa Brown	Milky Brown	100.00	poor	100.00	60.00	100.00	100.00	100.000	30.00	100.00	0-1	100.00	+++	100.00
	Milky	-	-	-	-	-	-	-	-	-	-	-	-	-
Frizzled Feather	Milky Brown	100.00	poor	100.00	20.00	100.00	30.00	100.00	50.00	100.00	0-1	100.00	+++	100.00
	Milky	-	-	-	-	-	-	-	-	-	-	-	-	-
Normal Feather	Milky Brown	100.00	good	100.00	40.00	100.00	30.00	100.00	30.00	100.00	0-1	100.00	+++	100.00
	milky	-	-	-	-	-	-	-	-	-	-	-	-	-
Naked neck	Milky brown	50.00	good	100.00	60.00	25.00	10.00	75.00	10.00	25.00	1-2	50.00	-	50.00
	milky	50.00	-	-	70.00	25.00	30.00	25.00	30.00	75.00	3-4	25.00	++	50.00
	-	-	-	-	80.00	50.00	-	-	-	-	2-3	25.00	-	-

TABLE 3: Haematological parameters in indigenous and two exotic breeds of chicken

Breeds	PCV (%)	HB (g/dl)	WBC ($x10^{12}$/l0L)	RBC ($x10^{9}$/l)	PLATELET ($x10^{9}$/L)	MCHC (g/ld)	MCH (pg)	MCV (fl)	N (%)	L (%)
Normal feather	31.43^{ab}	19.49^{ab}	10.00^{ab}	3.13^{ab}	157.14	32.57^{a}	31.75^{a}	96.29	44.00	56.00
Frizzled feather	20.50^{ab}	6.85^{b}	5.00^{b}	2.00^{b}	100.00	31.00^{b}	31.00^{b}	95.00	61.00	39.00
Isa brown	20.50^{ab}	6.70^{b}	2.00^{c}	2.00^{b}	100.00	31.00^{b}	31.00^{b}	94.00	60.00	40.00
Harco	35.00^{a}	11.70^{a}	12.00^{a}	3.50^{a}	100.00	33.00^{a}	32.00^{a}	97.00	45.00	55.00
SEM	0.26	1.20	0.23	0.23	100.00	0.27	0.27	0.48	3.46	3.46

a,b,c: Means within the same column carrying different superscripts differ significantly ($p<0.05$)

For puss cell, Harco had 1-2 pus cells with a percentage of 66.7% and 4-5 puss cells, with a percentage of 33.3%, Isa brown, Frizzled feathered and Normal feathered had pus cells of 0-1 and a percentage of 100%. Naked neck had various pus cells of 50.0%, 25.0% and 25.0% with a corresponding percentage of 50.0%, 50.0% and 0.0% respectively. The results of haematological parameters are presented in Table 3. From the results, significant differences ($P<0.05$) among breeds were observed in PVC, HB, WBC, RBC, MCHC and MCH. However no significant ($P<0.05$) differences was observed in platelet, MCV, N and L. The least square mean as represented in the table revealed that Harco has the highest packed cell volume (PVC) of 35.0%. This was followed by Normal feathered, Frizzled feathered and Isa brown with the corresponding mean values of 31.43%, 20.5% and 20.0% respectively. Also, for HB, Harco had the highest mean of 12.00($x10^9$/L) with Isa brown having the lower value of 2.00($x10^9$/L). It was also observed that Harco had the highest value of RBC (3.50($x10^{12}$/L)) with Isa brown and Frizzled feathered cocks having the lowest mean of 2.00($x10^{12}$/L) for MCHC. The results further revealed that Harco had the highest MCH of 32.00(pg) with Frizzled feathered and Isa brown cocks having the lowest mean value of 3.00(pg). The least mean square for platelet, MCV, L and N did not follow similar pattern with the rest. For platelet, Normal feathered had the highest mean of 157.14($x10^9$/L) while Frizzled feathered, Isa brown and Harco had the lowest value of 100.00($x10^9$/L). It was also observed that for MCV, Harco had the highest mean value of 97.00($x10^9$/L) with Isa brown having the lowest feather, having the lowest of 44.00($x10^9$/L). Finally, for Lymphocyte, normal feather had mean of 56.00 with frizzled feather, having the lowest of 39.00.

DISCUSSION

The significant variation in volume of semen across the breed in this study are in line with the works of Peter *et al*. (2008), whose values ranged from 0.37ml to 0.73ml for breeds of local and exotic chickens studied. It was also in agreement with the work of Ajayi *et al, (*2011) whose values ranged from 0.10ml to 0.83ml for 3 strains of local chickens studied. The values for total sperm count in the indigenous cocks (Naked neck and Normal feathered) were higher than the exotic breeds. Semen volume and total sperm count were significantly higher in the naked neck cocks. This could be attributed to the larger body sizes of the naked neck cocks. It has been observed that semen output is a function of body size (Egbunike and Oluyemi, 1979). The most obvious evaluation of semen quality is colour. Semen colour of the cocks in this study varied from milky to milky brown. It has been observed that variation in semen colour may arise partly due to the presence of contaminants (Etches, 1998) or as a result of low sperm concentration. The progression and high number of active sperm cells is an indication that these breeds can compete favourably with their exotic counterpart when used in artificial insemination (Al) programme. The significant variation in haematological parameters across breeds in PCV, HB, RBC, MCHC, and MCH reflects inherent genetic differences amongst the breeds. Agaie and Uko (1998), reported variation in RBC (erythrocyte) values due to season and species. Also, Oladele *et al.* (2001) and Adejumo (2004), attributed low values of PCV and HB to poor nutrition especially protein deficiency, whereas Ikhimioya *et al*. (2002) attributed low RBC (erythrocyte) values to system of management. These reasons cannot explain the variation found in this study since all the cocks were exposed to a common environment. Therefore the only logical factor implicated is chicken genotype. Lucas and Jamroz (1961) in their research explained that a sexually matured chicken at six weeks of age had PCV of 13% whereas at twelve weeks, PVC was 30% and packed cell volume of sexually mature female chicken was 29%. They however explained that PCV can be influenced by age, sex, hormone, cell size and other factors. The values for platelet (thrombocytes) reported in this study ranged from 100($x10^9$l L) to 157. Platelets are tiny cell fragments that play an essential part in blood clotting in case of injuries to prevent excessive loss of blood in the body. The values for MCV ranged between 93 and 98 FL. The normal MCV range is 80- 96FL.

CONCLUSION

It is concluded that in spite of previously unfavourable reports about the Nigerian indigenous birds such as poor growth rate, poor body conformation, small egg size and poor reproductive efficiency, it was observed from this study that semen from Nigerian indigenous cocks have comparable results with exotics cocks. This means that they can compete favourably with the exotic breeds in an Artificial Insemination programmes. It was also observed that the haematological parameters of the indigenous breeds had comparable results when compared to those of the exotic breeds.

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