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Effects of breed and sex on haematological indices of local and improved chickens raised in the South-south region of Nigeria

[1]Nweke-Okorocha, G. O. [2]Gunn, H. H. and [3]Agaviezor, B. O.
[1]Department of Animal production and Health, Federal University of Technology, Akure, Nigeria
[2]Department of Animal Science, Rivers State University, Port Harcourt, Nigeria
[3]Department of Animal Science, University of Port Harcourt, Port Harcourt, Nigeria.
Corresponding author: obynweke@hotmail.com

Abstract

The experiment was conducted to determine the effects of breed and sex on haematological indices of four strains of Nigerian local and improved chickens. This experiment examines and provides information on metabolites and other constituents in the four stains of Nigerian local and improved chickens used for this study. Blood metabolites plays an important role in the nutritional, pathological and physiological status of an animal. Stain, age and sex are among the factors that influence changes in blood-based parameters of farm animals. A total of 40 chickens (20 males and 20 females) from four stains of chickens (Frizzle feathered, Naked neck, normal feathered and Noiler) were selected at random from a population of 230 birds raised under intensive management. At 11th week, blood samples were collected from the birds and used for haematological analyses. Haemoglobin (Hb), red blood cell (RBC), white blood cell (WBC), packed cell volume (PCV), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular heamoglobin concentration (MCHC), erythrocyte sedimentation rate (ESR), lymphocytes (LYM), heterophils (HETER), monophils (MONO), basophils (BAS) and eosinophils (EOS). The results of the haematological indices revealed that the effect of strains and sex on haematological indices was significantly ($p<0.05$) different for erythrocyte sedimentation rate (ESR) and was significantly very high ($p<0.001$) for heterophils. Noiler chickens had higher least squares means for ESR(6.8 ± 1.3281 mm/iu). Naked neck chickens had higher least squares means for heterophils (39.60 ± 4.22%). Normal feathered chickens had higher least squares means for MCV (79.90 ± 0.30cbmm). The least squares means also indicated that there was no significant difference($p>0.05$) between sex for all the haematological indices. The female chickens had higher least squares means for ERS (4.95 ± 0.81 mm/iu), PCV (24.20 ± 0.10%), RBC (3.13 ± 0.11 x10^{6}cbmm), haemoglobin concentration (8.10 ± 0.42g/dl), heterophils (31.20 ± 3.63%), and mean cell haemoglobin concentration (33.47 ± 0.08g/%). The study revealed significant effect of strains on haematological indices among the local and improved chickens studied and the data generated could serve as baseline data for future improvement of the Nigerian native chicken strains

Keywords: Haematology, naked neck, frizzle feathered, normal feathered, noiler, Nigeria

Effets de la race et du sexe sur les indices hématologiques des poulets locaux et améliorés élevés dans la région sud-sud du Nigéria

Résumé

L'expérience a été menée pour déterminer les effets de la race et du sexe sur les indices hématologiques de quatre souches de poulets locaux et améliorés nigérians. Cette expérience examine et fournit des informations sur les métabolites et autres constituants

dans les quatre taches des poulets locaux et améliorés nigérians utilisés pour cette étude. Les métabolites sanguins jouent un rôle important dans le statut nutritionnel, pathologique et physiologique d'un animal. Les taches, l'âge et le sexe font partie des facteurs qui influencent les changements de paramètres basés sur le sang des animaux de la ferme. Au total 40 poulets (20 mâles et 20 femelles) de quatre taches de poulets (frisée à plumes à plumes, au cou nu, normal de plumes et de noiler) ont été sélectionnés au hasard d'une population de 230 oiseaux soulevés sous une gestion intense. À la 11e semaine, des échantillons de sang ont été collectés à partir des oiseaux et utilisés pour des analyses hématologiques. Hémoglobine (Hb), globules rouges (GR), globules blancs (GB), volume de cellules emballé (VCE), volume corpusculaire moyen (VCM), hémoglobine corpusculaire moyenne (MCH), concentration moyenne de hésioglobine corpusculaire (CMHC), sédimentation érythrocyte Taux (SET), Lymphocytes (Lym), Hétérophiles (Heter), Monophiles (Mono), Basophiles (Bas) et Eosinophiles (EOS). Les résultats des indices hématologiques ont révélé que l'effet des souches et des rapports sexuels sur les indices hématologiques était significativement (p <0,05) différent pour le taux de sédimentation érythrocytaire (SET) et était significativement très élevé (p <0,001) pour les hétéophiles. Les poulets de Noiler avaient des moyens plus élevés des moindres carrés pour SET (6,8 ± 1,3281 mm / IU). Les poulets nus du cou avaient des moyens plus élevés des moindres carrés pour les hétéophiles (39,60 ± 4,22%). Les poulets à plumes normaux avaient des moyens plus élevés des moindres carrés pour MCV (79,90 ± 0,30cbmm). Les moindres carrés signifie également indiquent qu'il n'y avait pas de différence significative (p> 0,05) entre le sexe pour tous les indices hématologiques. Les poulets femelles avaient des moyens plus élevés des moindres carrés pour ers (4,95 ± 0,81 mm / IU), VCE (24,20 ± 0,10%), GR (3.13 ± 0,11 x 106cbmm), concentration en hémoglobine (8,10 ± 0,42g / dl), hétérophiles (31,20 ± ± 0,42g / dl). 3,63%) et la concentration moyenne sur l'hémoglobine cellulaire (33,47 ± 0,08 g /%). L'étude a révélé un effet significatif des souches sur les indices hématologiques entre les poulets locaux et améliorés étudiés et les données générées pourraient servir de données de base pour l'amélioration future des souches de poulet indigènes nigérianes.

Mots-clés: hématologie, nuque nu, frisée à plumes, normale à plumes, noiler, Nigéria

Introduction

The Nigerian native chickens have the unique ability to hatch on their own, brood and scavenge for major parts of their food as well as possessing high immunity to endemic diseases. According to Ajayi *et al.* (2009) majority of Nigerians prefer the native chickens to their exotic counterparts due to their pigmentation, leanness and taste.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. Among these major genes are the Naked necked, Frizzled and Normal feathered. Haematological parameters provide valuable information on the immune status of animals (Kral and Suchy, 2000). Such information, apart from being useful for diagnostic and management purposes, could equally be incorporated into breeding programmes for the genetic improvement of indigenous chickens. It is desirable to know the normal physiological values under local conditions for proper management, feeding, breeding, prevention and treatment of diseases. Assessment of haematological indices have been used to assess the health status of animals in different researches (Iheukwumere *et al*., 2008; Oguike and Ude, 2008; Nweke-Okorocha and Chineke, 2017; Ilo and Ego, 2018; Adeyemo *et al*. 2018).Information

about hematological indices of Nigerian native chickens in the South-South region of the country are limited therefore, this study was carried out to evaluate the haematological indices of four strains of Nigerian local and improved chickens.

Materials and methods

The research was conducted at the Teaching and Research Farm of the Faculty of Agriculture, University of Port Harcourt, Port Harcourt suited in Obio-Akpor Local Government Area of River State, Nigeria. The site is located at longitude and latitude of 4.77N and 6.45E with an average temperature of 26^{o}C. Total of 40 chickens (20 males and 20 females) from 4 breeds (Frizzle feathered, Naked neck, Normal feathered and Noiler) were selected at random from a population of two hundred and forty birds raised under intensive management. The birds were fed properly and all necessary medication and vaccines were given. Fresh water was also provided adequately. Good biosecurity was also maintained. At the 11th week, birds were subjected to 12 hours fasting prior to blood collection. Three (3) mils of blood were aspirated from the wing vein of each bird using a sterile syringe and needle into blue top bottle containing K3-EDTA for haematological analysis. The haematological indices (Red blood cell, packed cell volume, haemoglobin, mean cell volume, mean cell haemoglobin, mean cell haemoglobin concentration, erythrocyte sedimentation rate, lymphocytes, heterophils, monophils, basophils and eosinophils) were determined on the day of collection by Shenzhen mind ray Auto Haematology Analyzer (Model Bc-3200, Shenzhen Mind ray Biomedical Electronics Co. Hamburg 20537, Germany). Data generated were subjected to least squares means using SAS 9.2 version 2008. Level of significance were reported at ($p<0.05$) and with the use of superscripts.

Results

Tables 1 and 2 present the least squares means and the standard errors for the effect of strains and sex on hematological indices of Frizzle feathered, Naked neck, Noiler and Normal feathered chickens at 11 weeks. Table 1 shows least squares means by strains for erythrocyte sedimentation rate (ESR), heterophils (HETER) and mean cell volume(MCV). Also the analysis of variance for strains effect was significant ($p<0.05$) for erythrocyte sedimentation rate (ESR) and was significantly very high ($p<0.001$) for heterophils (Table 3). Noiler chickens had higher least squares means for ESR(6.8 ± 1.32mm). Naked neck chickens had higher least squares means for heterophils (39.60 ± 4.22). Normal feathered chickens had higher least squares means for MCV (79.90 ± 0.30cbmm). The least squares means among strains for ESR ranged between 3.30 – 6.8mm/iu, packed cell volume ranged between 21.50 – 26.10%, HB from 7.10 – 8.80 g/dl, red blood cell (RBC) from 2.69 – 3.31x10^{6}cbmm, lymphocyte (LYM) ranged from 51.80 – 59.60%, heterophils ranged from 20.8 – 39.60%, monocytes (MONO) from 9.00- 13.10%, basophils (0.40 – 1.00%), eosinophils (EOS) from 0.9 – 1.00%, mean cell haemoglobin concentration(MCHC) (33.22 – 33.53g/%), mean cell haemoglobin (MCH)(26.34 – 26.60 pg) and mean cell volume (MCV) from 78.8 – 79.10. Table 2 shows the least squares means and standard errors for the effect of sex on hematological indices at 11 weeks of age. There was no significant ($p>0.05$) sex effect on all the haematological indices. The female chickens had higher least squares means for ERS (4.95 ± 0.81 mm/iu), PCV (24.20 ± 0.10%), RBC (3.13 ± 0.11 x10^{6}cbmm), haemoglobin concentration (8.10 ± 0.42g/dl), heterophils (31.20 ± 3.63), and

mean cell haemoglobin concentration (33.47 ± 0.08g/%) while male chickens had higher least squares means for on lymphocytes (57.23 ± 44.67%), monophils (11.50 ± 0.98%), basophils (0.95 ± 0.08%), eosinophils (0.95 ± 0.08%), mean cell haemoglobin (26.57 ± 0.11pg) and MCV (79.45 ± 0.28cbmm).The interaction between the Strain, sex and age indicated no significant effect (p>0.05) for the haematological parameters (Table 3)

Table 1: Least squares means and standard error for the effects of Strain on haematological indices of four Nigerian local and improved chickens at 11 weeks

Sources of variation	No. of observations	ESR (mm)	PCV (%)	RBC ($x10^6$cbmm)	HB (%/ml)	LYM (%)	HETER (%)	MONO (%)	BAS (%)	EOS (%)	MCHC (g/%)	MCH (pg)	MCV (cbmm)
Strain													
FZ	10	3.80±0.76 ^{b}	21.50±0.07	2.69 ± 0.25	7.50 ±0.65	56.80 ±6.74	30.50±4.32^{ab}	10.90±1.10	0.40±0.10	0.90±0.10	33.47±0.12	26.60±0.22	79.70±0.39^{ab}
NDNK	10	3.30 ± 0.42^{b}	22.20±2.46	2.8 ± 0.30	7.10 ±0.93	57.00 ±4.21	39.6 ±4.22^{a}	13.10±0.64	1.00±0.01	1.00±0.00	33.22±0.01	26.34 ±0.21	78.80 ± 0.33^{b}
NOILER	10	6.80 ±1.32^{a}	24.3 ±1.72	3.20 ± 0.11	8.10 ±0.60	51.80 ± 8.85	20.8 ±0.92^{b}	9.00 ± 2.12	0.90±0.18	0.90± 0.17	33.51±0.11	26.60 ±0.16	79.20 ±0.20^{ab}
NORMAL	10	3.80± 0.76^{b}	26.1 ± 0.72	3.31 ± 0.12	8.80 ±0.32	59.60 ± 6.93	28.30±0.31^{ab}	10.90±1.40	0.90±0.10	0.90± 0.17	33.53±0.13	26.38 ±0.30	79.90 ± 0.34^{a}
Overall effect	40	4.42 ± 0.47	23.52±0.95	3.01 ± 0.11	7.87 ±0.32	56.30 ± 3.33	29.80±2.18	10.70±0.76	0.93±0.05	0.93±0.05	33.43±0.06	26.48 ±0.11	79.40 ± 0.12

a, b: Means with different superscripts on same column are significantly different (p<0.05). M= male, F= female, FZ=Frizzle, NDNK=Naked neck, Normal= Normal feathered chicken, Noiler = Noiler, NO= number of observations (birds) used, ERS= erythrocyte sedimentation rate, PCV= packed cell volume, RBC= red blood cell, HB= hemoglobin concentra tion, MCHC = mean cell hemoglobin, MCH=mean cell hemoglobin concentration, MCV= mean cell volume, LYM = Lymphocyte, HETER= heterophils, MONO = Monocytes, BAS= Basophil, EOS = Eosinophil.

Table 2: Least squares means and standard error for the effects of sex on haematological indices of four strains Nigerian local and improved chickens at 11 week

Sources of variation	No. of observations	ESR (mm)	PCV (%)	RBC ($x10^6$cbm m)	HB (%/ml)	LYM (%)	HETER (%)	MONO (%)	BAS (%)	EOS (%)	MCHC (g/%)	MCH (pg)	MCV (cbmm)
SEX													
Female	20	4.95 ±0.81	24.20±0.10	3.13±0.11	8.10 ±0.42	55.35±4.88	31.20±3.63	10.45±1.16	0.90 ±0.06	0.90±0.60	33.47±0.08a	26.57±0.11	79.35±0.19
Male	20	3.90± 0.10	22.85±1.56	2.88±0.19	7.05 ±0.49	57.23±4.67	28.4±2.49	11.5±0.98	0.95 ±0.08	0.95±0.08	33.39±0.08a	26.38±0.19	79.45±0.28
Combined effect	40	4.42± 0.47	23.52±0.95	3.01± 0.11	7.87 ± 0.32	56.30±3.33	29.80±2.18	10.70±0.76	0.93 ±0.05	0.93±0.05	33.43±0.06	26.48±0.11	79.40±0.12

M= male, F= female, NO= number of observations (birds) used, ERS= erythrocyte sedimentation rate, PCV= packed cell volume, RBC = red blood cell, HB= hemoglobin concentration, MCHC = mean cell hemoglobin, MCH=mean cell hemoglobin concentration, MCV= mean cell volume, LYM = Lymphocyte, HETER= heterophils, MONO = Monocytes, BAS= Basophil, EOS = Eosinophil

Table 3: Means squares for the effects of strain and sex on haematological indices of four strains of Nigerian local and improved chickens at 11 weeks

Sources of variation	DF	ESR (mm)	PCV (%)	RBC ($x10^6$cbmm)	HB (%/ml)	LYM (%)	HETER (%)	MONO (%)	BAS (%)	EOS (%)	MCHC (g/%)	MCH (pg)	MCV (cbmm)
Strains	3	25.63*	43.62^{ns}	0.95^{ns}	5.49^{ns}	106.26^{ns}	599.26**	28.09^{ns}	0.03^{ns}	0.03^{ns}	0.21^{ns}	0.19^{ns}	2.4^{ns}
Sex	1	11.02^{ns}	18.22^{ns}	0.61^{ns}	2.02^{ns}	36.10^{ns}	78.40^{ns}	11.02^{ns}	0.03^{ns}	0.03^{ns}	0.06^{ns}	0.36^{ns}	0.10^{ns}
Strain*Sex*Age	3	3.02^{ns}	45.49^{ns}	0.41^{ns}	3.69^{ns}	103.26^{ns}	181.00^{ns}	28.95^{ns}	0.09^{ns}	0.09^{ns}	0.11^{ns}	0.09^{ns}	0.97^{ns}
Error	32	8.02	35.20	0.47	4.27	435	157.53	22.33	0.14	0.14	0.14	0.57	1.10

*=Significant (p<0.05). **= highly significant (p<0.001), ns= Not significant,
PCV = packed cell volume, RBC = red blood cell, HB = hemoglobin concentration, MCHC = mean cell hemoglobin, MCH = mean cell hemoglobin concentration, MCV= mean cell volume, LYM = Lymphocyte, HETER= Heterophils, MONO = Monocytes, BAS= Basophil, EOS = Eosinophil

Discussion

Haematological indices were used extensively in avian medicine as physiological indicators and disease diagnostic tools. Sex, Strain, age and nutrition are major factors affecting avian haematology (Oluyemi and Robert, 2000) though the variation in this study might be due to breed difference as the breeds were fed with same feed and were of the same age.The result of this study were in agreement with Pampori and Igbal (2007) who reported that the values of haemoglobin, packed cell volume, red blood cell and erythrocyte count were different among male and female native chickens of Kashmir. The results obtained in this study were the same range with the report by Adeyemo *et al*. (2018) who recorded PCV% range of 27-33.5% on three breeds of Nigerian indigenous chickens. Haemoglobin concentration (HB) values in this study were the same range with report by Adeyemo *et al*. (2018). Banerjee (2017) whose work recorded HB range of 7 – 13% but not in consonance with the report by Ilo and Egu (2018) who recorded higher values for HB in their study on Nigerian indigenous chickens. Haemoglobin concentration (HB) values in this study slightly differed from the report by Ihekwumere *et al.*(2006).

Solomon and Udoh (2012) recorded HB range of 9.36 ±0.01 – 9.39 ± 0.00g/dl and 8.05 – 9.74 respectively for Nigerian indigenous chickens. The values of the hematological parameter evaluated in this study corroborated with the result of Olabanji *et al*. (2007),Togun *et al*. (2007), Etim *et al*. (2014), Nweke-Okorocha and Chineke (2017) who confirmed that the observed value for haematogical parameters in their study fell within the Normal range for healthy birds. The value of red blood cell (RBC) obtained in this study were in consonance with the report of Nweke-Okorocha and Chineke (2017), Ilo and Egu (2018) whose work recorded RBC ranged from 2.1–3.00x10^6cbmm and 3.62-4.33x10^6cbmm respectively for Nigerian indigenous chickens. The value of heterophils in this study was not in agreement with the value obtained by Adeyemo *et al*. (2018) who reported heterophil range from 58.89 – 75.56% for three genotypes of Nigerian indigenous chickens. The value of mean cell haemoglobin concentration (MCHC) were within the range of 26.0 – 35.0g/% reported by Banerjee (2017) for chickens and Islam *et al*. (2014) for local chickens in Bangladesh and also corroborated the value reported by Ilo and Egu (2017) whose work recorded MCHC value range from 33.68% - 33.88% in three Nigerian indigenous chickens. Mean cell haemoglobin concentration value in this study was in agreement with report by Nweke-Okorocha and Chineke (2017), Adeyemo *et al*. (2018) whose work recorded MCHC range of 31.11 – 33.35g/%. Mean cell haemoglobin (MCH) values were lower than the values reported by Ilo and Egu (2018); Ibrahim (2012) whose work recorded MCH values range from 30.52 – 35.31pg, 30.7 -34.10pg respectively in local chickens. However, MCH value obtained in this study corroborated with the report of Adeyemo *et al*. (2018) who reported MCH value range from 18.22 -25.13 for three genotypes of Nigerian indigenous chickens. The values of lymphocyte in this study were higher than the range value of 26.67 – 44.33% recorded by Adeyemo *et al*. (2018) for three Nigerian local chickens but in consonance with value reported by Nweke-Okorocha and Chineke (2017) whose work recorded lymphocyte range values from 56.20 – 56.53. This variation could be due to age and nutritional status of the animals (Albritton, 1981 and Adeyemo, 2018).

Conclusion

The information from the haematological

indices in this study revealed significant effects of strain on haematological indices among the Nigerian chickens studied. It also revealed that sex did not significantly affect the haematological indices and could be used as baseline data for future improvement of the health status of Nigerian local chickens.

References

Adeyemo, G. O., Bolarinwa, M. O. 1., Ehiabhi, O. 2018. Hematology and external egg quality parameters of three Nigerian indigenous chicken genotypes. *International Journal of Molecular Biology: Volume 3 Issue 4:197–20.*

Ajayi, F. O. Agaviezor, B. O. and Torukuru, S. 2009. Fertility and hatchability of indigenous chicken as influenced by major genes in the rainforest zone of Nigeria. Proceedings of the 13th Annual Animal Science Association of Nigeria, September 15th -19th, 2008, Ahmadu Bello University, Zaria, pp. 81-83.

Albritton A. B. 1981.*Standard value in Blood*. Philadelphia WB Saunders; 1981:19.

Banerjee, G. C. 2007. A Textbook of Animal Husbandry (8th edition). *Oxford and IBH Publishing* co PVT Ltd New Delhi India

Etim, N. A., Enynihi, G. E., Akpabio, U. and Offiong, E. A. 2014. Effect of nutrition on haematology of rabbit: A review *European Scientific Journal*. Volume 10 (3).

Ibrahim, A.A, Hassan A.M, Wada N.I, Aliyu. J. 2011. Effect of sex and genotype on blood serum electrolytes and biochemical parameters of Nigerian indigenous chickens.*Iranian journal of applied animal science.* Volume 2(4):361-365

Iheukwumere, F. C., Abu, A. H., &Ameh, M. 2006. Effect of human menopausal gonadotrophin on haematological and serum biochemical parameters of Nigerian indigenous chickens.*International Journal of Poultry Sciences*, 5(7), 632634.

Ilo, S. U. and Egu, U. N. 2018. Effect of genotype on haematology and serum biochemistry of Nigerian indigenous roosters (cockerels).*Journal of Agricultural Science and Practice* Volume 3(6), pages 161-166, https://doi.org/10.31248/JASP2018.106

Islam, A. M. And Nishibori, M. 2009. Indigenous naked neck chicken: Avaluable genetic resource for Bangladesh. *World Poultry Science Journal*, 65: 125 – 138.

Kral, I. and P. Suchy, 2000. Haematological studies in adolescent breeding cocks. Acta Vet. Bmo., 69: 189-194.

Nweke-Okorocha, O.G and Chineke 2017. Haematological studies in fulani ecotype chickens in South West Nigeria. *International Journal of Innovative Research and development.volume*6 issue 7 pp 151-154

Oguike, M. A. and Ude, N. E. 2008. Influence of the Ethno veterinary plant, Spondiasmombi L. on partial daily milk yield (PDM), haematology and serum biochemistry of lactating West African Dwarf (WAD) ewes. *Journal of Animal Veterinary Advances.* 7, 584-588.

Olabanji, R.O., Ffarinu, G.O.Akinlade, J.A., Ojebiyi, O.O., Odunisi, A.A and Akingbade,, A.A 2007. Haeamatological and serum biochemical characteristics of

weaner rabbits fed different level of wild flower, leaf blood meal mixture. *International Journal of applied Agricultural Research.* Volume; (12) page 1014-1021.

Oluyemi J. A, Roberts F. A. 2000.Poultry production in warm wet climate. 3rd ed. London: *Mac Millan publisher;* 2000

Pampori, Z. A. and Iqbal, S. 2007. Hematology, serum chemistry and electro cordiographic evaluation in native chicken of Kashmir. International Journal of Poultry Science, 6, 578-582. https://doi.org/10.3923/ijps.2007.578.582

Togun, V.A., Oseni, B.S.A.., Ovundipe, J.A, Arewa, T.R., Hammed, A.A., Ajaniegbu, D.C., Mustapha, F 2007. Effect of chronic lead administration on haematological parameter of rabbits. A preliminary study *proceeding of 41st conference of the Agricultural Society of Nigeria*. Pg 341

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