PREDICTION OF HAEMATOLOGICAL PARAMETERS OF FOUR-CHICKEN STRAINS USING SIMPLE LINEAR FUNCTION

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ABSTRACT
The objective of the study was to establish the relationship existing between haematological parameters by predicting the packed cell volume (PCV) of chickens from the other haematological variables in a study that was conducted at the Federal University of Technology, Akure Teaching and Research Farm. A total of 120-day old chicks of four strains were purchased from reputable Farm at 30 chicks per strain and used for the study that lasted eight (8) weeks. The experiment was arranged in a completely randomized design and the birds were distributed into four treatments according to their strain. Each group was replicated three times at 10 birds per replicate. The birds were fed experimental diet *ad-libitum* containing 23% crude protein and 2685.49Kcal/kg metabolizable energy during the period of the experiment. Adequate health preventive measures were ensured during the period of the study. At the end of the experiment, blood samples were collected from 12 birds per strain and were analyzed on computer using SAS (2008). Results showed that haematological parameters were highly significant ($p<0.01$) among the four chicken strains. Coefficient of determination (R^2) was highest in Haemoglobin for Naked neck breed with the value of 99.84%. Haemaglobin had the higher accuracy of prediction. This function was best with Marshall broilers compared to other chicken strains used for the study. White blood cells generally contributed low to PCV. It was concluded that Red Blood Cell (RBC) was the best predictor of PCV from other haematological variables across the chicken strains. Haematological parameters could be used to predict PCV in chickens and they could be used to assess the well being of poultry birds. This could help to generate baseline information necessary for breeding plans and improvement of the Nigeria Indigenous chickens.

Keywords: Indigenous, relationship, prediction, haematological parameters and improvement,

INTRODUCTION

Traditional poultry production in Nigeria is practiced in rural and semi-urban areas where conditions permit settlement of life. The household poultry production system is based on scavenging indigenous domestic chickens which may be accompanied by pigeons, guinea fowls, ducks or turkeys. Indigenous birds are usually raised as scavengers in an open yard, scratching and picking on the grounds (Ravi-Kumar *et al*., 2002). Analysis of haematological parameters of chickens is essential for the diagnosis of various pathological and metabolic disorders. It can be used as a diagnostic tool in order to assess the health status of an individual and/or a flock. Haematological changes are commonly used to determine the body status and to assess the impact of environmental, nutritional and/or pathological stresses.

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. Meager information about the local ecotypes of birds and their characterization are available in the literature and no reliable data describing traditional poultry production are available. However, normal haematological information on Nigerian indigenous birds is hardly available in the literature as researches on these chickens had rarely been carried out. The present study was designed to partly rectify this deficiency and to provide baseline data on haematological parameters of some indigenous chickens in Nigeria.

MATERIALS AND METHODS

The study was carried out at Teaching and Research Farm, Livestock Section (Poultry Unit) of the Federal University of Technology, Akure, Ondo State, Nigeria with Latitude 07° 16^1 and 07° 18^1 N and Longitude 05° 09^1 and 05° 11^1 E. There is a unimodal rainfall pattern which starts from April to October and average of 1556mm per annum. The average ambient temperature was about 30 - 32°C and relative humidity of 80% (Climate data, 2018).

A total of 120-day old chicks were purchased from reputable farms in Abeokuta and Ibadan, Ogun and Oyo States of Nigeria. Thirty (30) chicks of each strain were procured and used for the study that lasted eight (8) weeks. The strains were normal feather, naked neck, frizzle feather and Marshall Chickens. The experiment was arranged in a completely randomized design (CRD) and the birds were distributed into four treatments according to their strain. Each strain was replicated three times at 10 birds per replicate. The birds were fed experimental diet *ad-libitum* containing 23% crude protein and 2685.49Kcal/kg metabolizable energy. Adequate health preventive measures were ensured during the period of the experiment. At the end of the experiment, 2ml blood samples were collected from twelve (12) birds per strain and emptied into well labelled ethylene diamine tetra acetate (EDTA) bottles. These blood samples were taken to the haematology Laboratory of the Department of Animal Production and Health of the University for Laboratory analyses of haematological parameters using Lamb (1981) procedure. All blood samples were collected at about the same time. The blood collection tubes were kept on ice pack in cool containers to avoid denaturing of proteins and were taken to the laboratory within 2 hours of collection. The haematological parameters studied were: packed cell volume (PCV), erythrocyte sedimentation rate (ESR), red blood cells (RBC), haemoglobin concentration (HBC) and the differential white blood cell (Heterophils, Basophils, Eosinophils, Monocytes and Lymphocytes). The blood constants (mean corpuscular haemoglobin concentration, Mean cell haemoglobin and Mean cell volume) were determined using standard formulae.

Data generated were analyzed on computer using SAS (2008) version 13 statistical software. Where significant differences were observed, means were separated using appropriate subroutine of the same statistical package. The statistical model used was:

$Yij = \mu + Ti + \epsilon ij$

Where

Yij= Haematology of jth bird in the ith strain (j = 1- 30)

μ = General mean

Ti = Fixed effect of the ith strain (i = 1- 4)

ϵij = Residual error

RESULTS AND DISCUSSION

The estimation of PCV from other haematological parameters in Table 1 showed that most of the haematological parameters were highly significant ($p<0.01$) among the four strains with Erythrocyte Sedimentation Rate (ESR), Mean Cell Volume (MCV), Mean Cell Haemoglobin (MCH), Basophils (BAS), Haemoglobin (HB), Red Blood Cell (RBC), Eosinophils (EOS) and Monocytes (MON), while the Table equally revealed that Lymphocyte (LYM), Mean Cell Haemoglobin Concentration (MCHC) and Heterophil (HET) were not significantly different ($p>0.05$). Generally, the coefficient of determination (R^2) was highest in Haemoglobin (HB) for Naked neck (NN), Normal feather (NF), Frizzle feather (FF) and Marshal broiler (MB) with the various values 99.84 %, 99.81 %, 99.97 % and 99.94 % respectively and lowest in MCHC for NN with 0.00, BAS and EOS for NF with 0.00, EOS for FF with 0.10 and HET for MB with 0.21 as shown in Table 1. The function was best described in Marshall Broilers compared to other chicken strains used for the study.

On the estimation of PCV from other haematological variables, Red blood cells (x_2) had the highest contribution to the value of PCV in all the strains used in this study. Low contribution from the White blood cells showed that the experimental birds were clinically free from infectious micro-organisms (peters

et al., 2011) during the period of the study. On the basis of coefficient of determination (R^2), Haemaglobin (x_3) had the higher accuracy of prediction. Generally, all the haematological parameters were highly significant ($p<0.01$).

CONCLUSION AND RECOMMENDATIONS

The present study showed that the estimations of PCV from the other haematological parameters were generally significant across the strains used in the study. The estimation of Packed Cell Volume (PCV) from other haematological parameters using linear function revealed that Red Blood Cell (RBC) was the best predictor of PCV among the strains. Haemoglobin (x_3) had the highest accuracy of predictions based on the values of coefficient of determination (R^2). Packed Cell Volume (PCV) could be used to determine the health and immunological status of chickens.

In general, the result showed that haematological parameters could be used to predict the PCV of poultry birds. They could also be used to assess the well being of poultry birds vis-a-vis their health and physiological status. This study would help to generate baseline information necessary for breeding plans and improvement of the Nigeria Indigenous chickens. It was recommended that government and stakeholders should provide adequate funding for researches on indigenous chicken production.

Table 1: Estimation of PCV in simple linear function fitted for PCV–other haematological parameters for the various chicken genotypes

Breeds	Functions	SE	R^2 (%)	LS
NN	$Y = 32.17 – 3.42X_1$	0.73	73.53	***
	$Y = 16.07 + 4.42X_2$	0.44	93.83	***
	$Y = 0.04 + 3.00X_3$	0.04	99.84	***
	$Y = 40.41 – 0.34X_4$	0.02	77.17	***
	$Y = 40.55 – 0.34X_5$	0.06	77.89	***
	$Y = 25.97 + 0.02X_6$	7.17	0.00	NS
	$Y = 13.54 + 0.22X_7$	0.32	5.50	NS
	$Y = 30.17 – 0.15X_8$	0.25	4.66	NS
	$Y = 25.94 + 0.06X_9$	0.23	0.23	***
	$Y = 30.43 – 1.38X_{10}$	1.42	10.51	***
	$Y = 24.00 + 1.50X_{11}$	1.64	9.45	***
NF	$Y = 29.26 – 1.85X_1$	0.36	77.16	***
	$Y = 15.13 + 5.15X_2$	0.65	88.80	***
	$Y = 0.15 – 3.02X_3$	0.05	99.81	***
	$Y = 38.65 – 0.10X_4$	0.01	84.69	***
	$Y = 38.70 – 0.31X_5$	0.04	86.01	***
	$Y = 172.26 – 4.42X_6$	5.65	7.08	NS
	$Y = 2.11 + 0.37X_7$	0.21	28.81	NS
	$Y = 34.29 – 0.44X_8$	0.18	41.38	***
	$Y = 24.86 + 0.01X_9$	0.22	0.30	***
	$Y = 25.00 + 0.00X_{10}$	2.24	0.00	**
	$Y = 25.00 + 0.00X_{11}$	2.24	0.00	**
FF	$Y = 33.28 – 2.94X_1$	0.84	66.17	***
	$Y = 14.05 + 5.83X_2$	0.23	99.11	***
	$Y = 0.16 – 3.02X_3$	0.02	99.97	***
	$Y = 49.12 – 3.02X_4$	0.02	91.22	***
	$Y = 48.81 – 0.50X_5$	0.07	90.63	***
	$Y = 621.21 – 17.81X_6$	16.25	16.68	NS
	$Y = 48.06 + 1.25X_7$	1.07	78.49	NS
	$Y = 26.72 + 0.07X_8$	0.75	12.0%	NS
	$Y = 33.87 – 0.46X_9$	0.60	86.50	***
	$Y = 22.13 + 2.00X_{10}$	3.75	45.20	NS
	$Y = 27.86 + 0.14X_{11}$	5.80	0.10	**
MB	$Y = 32.50 – 3.25X_1$	1.28	61.68	***
	$Y = 14.86 + 5.44X_2$	0.80	92.00	***
	$Y = 0.16 + 2.99X_3$	0.04	99.94	***
	$Y = 44.69 – 0.14X_4$	0.05	66.73	***
	$Y = 44.81 – 0.43X_5$	0.15	66.80	***
	$Y = 40.65 – 8.08X_6$	16.65	5.57	NS
	$Y = 22.50 + 0.09X_7$	0.30	2.29	NS
	$Y = 27.32 + 0.04X_8$	0.44	0.21	**
	$Y = 36.48 – 0.67X_9$	0.51	30.50	**
	$Y = 23.67 + 1.50X_{10}$	1.51	19.71	**
	$Y = 34.40 – 3.40X_{11}$	1.99	42.19	***

FF= Frizzled feathered, MB= Marshal broiler, NF= Normal feathered, NN = Naked neck, HB=Haemoglobin, MCV = Mean Cell Volume, MCH = Mean Cell Haemoglobin, MCHC = Mean Cell Haemoglobin Concentration, LYM = Lymphocytes, HET = Heterophils, MON = Monocytes, BAS = Basophils, PCV = Packed Cell Volume, ESR = Erythrocytes Sedimentation Rate, RBC = Red Blood Cell, EOS = Eosinophils. Y = PCV, X_1 = ESR, X_2 = RBC, X_3 = HB, X_4 = MCV, X_5 = MCH, X_6 = MCHC, X_7 = LYM, X_8 = HET, X_9 = MON, X_{10} = BAS, X_{11} = EOS. ** significant ($p<0.01$), *** significant ($p<0.001$), NS = not significant, R^2 = Coefficient of determination, LS = Level of significance, SE = Standard error.

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