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Haematological Parameters of Japanese Quail(*Coturnix Coturnix Japonica*) Raised on Deep Litter System in South Western Nigeria

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ABSTRACT

This study aimed to determine the haematological values as well as the phenotypic correlation among the parameters of haematology. One hundred and twenty (120) Japanese quails were raised on a deep litter system. Two experimental diets (starter diet and layers diet) were given to the birds. Blood samples were taken from the birds at six (6) weeks for haematological analysis. According to the result obtained, sex did not have any significant (P> 0.05) effect on any of the haematological parameter. Meanwhile, it was also observed that increment in body weight was found supportive of the haematological parameters.

Introduction

Japanese quail, the smallest farmed avian species (Panda and Singh 1990), is getting more important for commercial egg and meat production. It has marked advantages such as fast growth, early sexual maturity, high egg production rate, short generation interval and short incubation period. The average age at onset of laying for Japanese quail is 6-8 weeks (Reddish *et al*., 2003), and with proper care, quail hens can lay up to 280 -300 eggs in their first year. Quail breeding is increasingly becoming more widespread since it is possible to achieve yields in much more limited spaces, without substantial investments and within shorter periods compared to other types of poultry breeding. Quails are much more resistant to adverse environmental factors (Nagarajan *et al.*, 1991). Quail production has been on a large scale in many countries worldwide. In Nigeria, for example, some research institutes have gone into commercial production and investigation into nutritional and disease control of quail birds (Lombin, 2007). Quails are therefore suitable for genetic studies since they rapidly attain sexual maturity (Khare *et al.*, 1975). Haematological and biochemical analyses of the Japanese quail at different growth phases showed that the biochemical profile of the bird changes with age. However, it does not seem to affect the haematological parameters (Ali *et al.*, 2012). Haematological values are essential in poultry haemoparasitic infections diagnosis (Binta *et al.*, 1996). Blood consists of a straw-coloured fluid medium called plasma in which red blood cells (erythrocytes), white blood cells (leucocytes) and platelets (thrombocytes) are suspended. As a complex solution of proteins, salts and numerous metabolic substances, plasma acts as a transport medium carrying its constituents to specialised organs of the body. Puspamitra *et al.* (2014) reported that the mean value of Hb, RBC and PCV differed highly
significantly ($p<0.001$) between different age groups of Japanese quail. And that WBC, MCH ($p<0.01$) and MCV, MCHC ($p<0.05$) indicate a significant difference between different age groups. This present study aimed to provide helpful information on the haematological parameters of Japanese quail raised in a commercial (natural) production system. Farmers in southwestern Nigeria could be encouraged to commercial Japanese quail production.

Materials and Method

Experimental Materials

One hundred and twenty (120) Japanese quails were used for this experiment. They were obtained from the National Veterinary Research Institute (NVRI), Vom, Jos, Plateau State, at their Ikire outstation, Osun State, Nigeria.

Experimental Diets

Two (2) experimental diets were formulated and prepared in the Nutrition Laboratory of the Federal University of Technology, Akure. One is the starter diet and the other the layer diet. The basal and proximate compositions of the experimental diets are shown in tables 1 and 2, respectively.

Tables 1. Basal composition of the experimental diet (%)

Ingredients	Diet I (Starter)	Diet II (Layer)
Maise	59.16	54.81
SBM (42%)	35.17	21.07
Fish meal (65 %)	1.6	2.1
Oyster shell	1.6	8.4
Methionine	0.22	0.21
Lysine	0.16	0.21
Broiler premix*	0.24	--
Salt	0.24	0.25
Bone	1.6	2.1
Wheat offal	--	10.54
Layers premix		0.25
Total	100	100

SBM=Soya Beam Meal.

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Table 2. Proximate composition of the experimental diets

Nutrients	Starter diet	Layers diet
Metabolizable energy (Kcal/K)	2829.6	2696
Crude protein (%)	19.76	18
Ether extract (%)	3.8	3.90
Crude fibre (%)	3.36	2.91
Lysine (%)	1.3	0.9
Methionine (%)	0.6	0.42
Calcium (%)	0.9	3.7
Phosphorus (%)	0.45	0.35

The metabolisable energy is in kcal while others are in percentages.

Slaughtering and Collection of Blood

A total of five male and female quails were selected respectively, weighed and slaughtered, and blood samples were taken. Sample taken from each quail was divided into two parts. Ethylenediaminetetraacetic acid (EDTA) was added to a part while the other part was not anticoagulated to obtain serum from it.

Haematological Studies

Packed Cell Volume (PCV)

The blood sample with anticoagulant was gently mixed in the bottles and drained up in a micro haematocrit capillary tube of ¾ of its length. Plasticine was used to seal one end of the tube and, after that, made to stand for an hour to take the erythrocyte sedimentation rate (ESR). The tubes were then placed in a microhaematocrit with the plasticine end outward and were centrifuged at 1200 rpm for 4 minutes. The readings were then taken in the haematocrit reader, which expressed the packed cell volume as a unit of the total blood volume.

Red Blood Cell (RBC) Count

Red Cell Pipette was used to take 0.5 marks of the adequately mixed anticoagulated blood samples. The pipette's tip was wiped with tissue paper and was used to draw up saline to its 101 mark. The blood sample was carefully mixed by shaking the solution for about 30 seconds. One-quarter of the content was expelled before the counting chamber, and the counting chamber was allowed to stand for about one minute to get the red cell settled. A counter was now used to count the red cell using the x40 objectives and the x80 eyepiece of the microscope.

Haemoglobin Concentration (HBC)

The colourimetric method was used in taking this reading. 1g of pure haemoglobin was weighed out and dissolved in 10ml of distilled water using a glass rod to stir continuously until all the haemoglobin thoroughly dissolved. An automatic filling pipette was used to take 0.02ml of each of the well-mixed blood samples, and such was put into the labelled test tube containing 4ml of Drabkin's solution. The solution (Drabkin's) was repeatedly pipetted and ejected until complete flushing out of the blood was done. Regular cleaning of the tip of the pipettes was done to avoid contamination of the blood with the solution. The test tubes were covered, contents were thoroughly mixed using an automatic mixer and lift to stand for 5 minutes to allow full-colour development. The preparation of a standard dilution was done in the same way as the haemoglobin standard. The filter (green) was fitted into the colourimeter, which was switched on and coloured to warm for 15 minutes. Afterwards, the colourimeter was set to zero, setting its wavelength at 624nm. Setting the zero full scale, a blank (Drabkin's) solution was inserted, and the standard solution and the reading records were taken. The corresponding records of the reading of the labelled sample solution were taken as they were being inserted.

Absolute Haematological Values

The following absolute values were calculated from the blood parameters, RBC count, PCV count, and haemoglobin concentration.

Mean Cell Haemoglobin Concentration (MCHC)

The MCHC gives haemoglobin concentration in g/l in 1litre of packed red cells. It was calculated from the haemoglobin and PCV as follows:

$$\frac{\text{Hb (g/dl)}}{\text{PCV (\%)}} \times 100 = \text{MCHC (g/dl)}$$

Means Cell Volume (MCV)

It is measured in femtolitres (fl), determined from the PCV and RBC count. It was calculated as follows:

$$\frac{\text{PCV (\%)}}{\text{RBC (x } 10^{12}\text{/l)}} \times 10 = \text{MCV(fl)}$$

Where $Fl=10^{-15}$ of a litre.

Mean Cell Haemoglobin

The mean corpuscular haemoglobin **is** the haemoglobin in picograms (Pg) in an average red cell. It is calculated from the haemoglobin and RBC count.

$$\text{MCH (pg)} = \frac{\text{Hb (g/dl)}}{\text{RBC (X } 10^{12}\text{/l)}}$$

Where a picogram (pg) = 10^{-12} of a gram.

White Blood Cells Count

A thin film of the blood sample was prepared using the Leishman staining technique. A drop of immersion oil was placed on the lower third of the blood film and was covered with a clean cover glass. The film was examined microscopically, and the x10 objective was used to focus the cells with its condenser iris closed sufficiently to see the cells. The point where the red cells were beginning to overlap was focused with x40 objectives, and the iris diaphragm was opened the more. The blood film was systematically examined, and the different white cells in each field were counted with the aid of an automatic differential cell counter.

Statistical Analysis

The data collected were subjected to analysis and presented as mean± standard error (S.E) and, the Duncan Multiple Range Test by using Statistical Analytical System (SAS) (2008), NC, USA and one-way analysis of variance (ANOVA) was used to assess the significance of differences at $p<0.05$, $p<0.01$ and $p<0.001$.

Results

Table 3. Overall mean and standard error of haematological values

Parameter	Mean	SE
BW (g)	126.40	4.38
ESR (mm/hr)	1.00	0.10
PCV(%)	47.10	1.57
RBC(×106/mm3)	36.23	1.56
Hb (g/dl)	15.67	0.52
MCHC (g/dl)	0.33	0.002
MCV (fl)	0.12	0.004
MCH (pg)	0.04	0.001
LYM (%)	59.00	0.88
NEU (%)	25.10	0.57
MON (%)	12.60	0.74
BAS (%)	2.10	0.10
EOS (%)	1.20	0.14

BW = Body Weight, ESR = Erythrocyte Sedimentation Rate, PCV = Packed Cell Volume, RBC = Red Blood Cell Content, HB = Haemoglobin Content, MCHC = Mean Cell Haemoglobin Concentration, MCV = Mean Cell Volume, MCH = Mean Cell Haemoglobin, LYM = Lymphocytes, NEU = Neutrophils, MON = Monocytes, BAS = Basophils, EOS = Eosinophils.

Table 4. Duncan Multiple Range Test for haematological parameters

Parameter	Means	
	Male	Female
BW (g)	118.84[a]	133.96[a]
ESR (mm/hr)	0.90[a]	1.10[a]
PCV(%)	50.20[a]	44.00[a]
RBC(×106/mm3)	393.60[a]	331.00[a]
Hb (g/dl)	16.70[a]	14.64[a]
MCHC (g/dl)	0.32[a]	0.33[a]
MCV (fl)	0.12[a]	0.13[a]
MCH (pg)	0.04[a]	0.04[a]
LYM (%)	59.00[a]	59.00[a]
NEU (%)	25.20[a]	25,00[a]
MON (%)	12.60[a]	12.60[a]
EOS (%)	1.20[a]	1.20[a]

Means with the same superscript are not significantly (P>0.05) different.

Table 5. Repeatability estimates of haematological parameters

	BW	ESR	PCV	RBC	HB	MCHC	MCV	MCH	LYM	NEV	MON	MAS	EOS
BW (g)	0.39	-0.82	0.00	0.00	0.00	0.28	0.50	-0.20	-0.20	-0.59	-0.23	-0.23	-0.20
ESR (mm/hr)		0.00	0.51	0.30	0.52	0.25	0.04	0.00	-0.16	-0.50	-0.16	-0.50	0.00
PCV(%)			0.57	0.97	0.56	-0.20	-0.78	-0.20	-0.20	0.06	-0.20	0.96	-0.19
RBC($\times10^6$/mm^3)				0.58	0.99	-0.14	0.10	0.23	-0.48	0.40	-0.20	0.16	0.20
Hb (g/dl)					0.55	0.20	-0.75	-0.23	-0.20	0.06	-0.20	0.94	0.20
MCHC (g/dl)						0.00	-0.22	-0.20	-0.20	-0.11	0.20	0.20	-0.20
MCV (fl)							0.00	-0.20	0.12	-0.25	-0.20	-0.60	-0.20
MCH (pg)								0.00	-0.23	-0.20	-0.16	0.25	0.14
LYM (%)									0.00	-0.20	-0.20	0.18	0.16
NEU (%)										0.00	0.20	0.13	-0.25
MON (%)											0.00	-0.14	-0.25
BAS (%)												0.00	0.25
EOS (%)													0.00

BW = Body Weight, ESR = Erythrocyte Sedimentation Rate, PCV = Packed Cell Volume, RBC = Red Blood Cell Count, HB = Haemoglobin, MCHC = Mean Cell Haemoglobin Concentration, MCV = Mean Cell Volume, MCH = Mean Cell Haemoglobin, LYM = Lymphocytes, NEU = Neutrophils, MON = Monocytes, BAS = Basophils, EOS = Eosinophils.

Table 6. Phenotypic Correlations Among Parameters Of Haematological Values

	BW	**ESR**	**PCV**	**RBC**	**HB**	**MCHC**	**MCV**	**MCH**	**LYM**	**NEU**	**MON**	**BAS**	**EOS**
BW (g)	1.00	0.06	-0.45	-0.46	-0.45	0.16	0.20	0.14	-0.19	0.05	0.09	0.23	0.35
ESR (mm/hr)		1.00	-0.62	-0.78	-0.61	-0.35	0.36	0.00	-0.16	-0.01	0.19	0.09	0.00
PCV(%)			1.00	0.82	1.00	-0.09	-0.03	0.31	0.15	0.38	-0.43	-0.51	0.13
RBC(×106/mm3)				1.00	0.82	0.11	-0.52	-0.10	0.19	0.12	-0.27	-0.35	-0.07
Hb (g/dl)					1.00	-0.10	-0.03	0.31	0.16	0.38	-0.44	-0.51	0.13
MCHC (g/dl)						1.00	-0.31	-0.10	0.38	-0.47	-0.16	0.68	0.10
MCV (fl)							1.00	055	-0.18	0.23	-0.02	-0.13	0.38
MCH (pg)								1.00	0.24	0.22	-0.49	-0.14	0.30
LYM (%)									1.00	-0.43	-0.64	0.34	-0.88
NEU (%)										1.00	-0.37	-0.55	-0.02
MON (%)											1.00	-0.08	-0.01
MAS (%)												1.00	-0.14
EOS (%)													1.00

BW = Body Weight, ESR = Erythrocyte Sedimentation Rate, PCV = Packed Cell Volume, RBC = Red Blood Cell Content, HB = Haemoglobin Content, MCHC=Mean Cell Haemoglobin Concentration, MCV=Mean Cell Volume, MCH=Mean Cell Haemoglobin, LYM=Lymphocytes, NEU=Neutrophils, MON=Monocytes, BAS=Basophils, EOS=Eosinophils.

Effect of Sex on Haematological Parameters

Table 4 shows that there was no significant effect (P>0.05) of sex on any of the parameters of haematology tested.

Phenotypic correlations among haematological values

Table 6. depicts the fact that the body weights of the quails have a positive phenotypic correlation with the mean cell volume, mean cell haemoglobin concentration, erythrocyte sedimentation rate and all white blood cells except for lymphocytes with which it has a negative phenotypic correlation. A negative phenotypic correlation exists between the body weight and the packed cell volume, haemoglobin concentration, and red blood cells count. Monocyte, one of the white blood cells, had negative phenotypic correlations with all other parameters except for body weight and erythrocyte sedimentation rate. Erythrocyte sedimentation rate has zero correlation with mean cell haemoglobin and eosinophils. It correlates positively with mean cell volume and monocytes, while a negative correlation exists between it and other haematological values. Packed cell volume negatively correlates with mean cell haemoglobin concentration, mean cell volume, monocytes and basophils, while it positively correlates with all other values. Neutrophils had negative correlation values with others and positive correlation values with some.

Discussion

Effect of sex on Haematological parameters

This experiment revealed that sex did not influence (P>0.05) haematological parameters taken at week six of age. This agrees with the report of Hassan *et al*. (2003). He stated

that sex had no significant effect on monocytes and Eosinophils levels of Japanese quails taken at week 5. So, if need be for other researchers to look into the effect of sex on haematological parameters at other ages beyond six weeks in Japanese quail.

Phenotypic correlations among parameters of haematological values

There was a positive correlation between the body weight, mean cell volume, mean cell haemoglobin concentration, erythrocyte sedimentation rate, and all white blood cells except lymphocytes. This was a pointer to the fact that selection is made for bodyweight improvement; improvement of all mentioned parameters would automatically be made. The improvement is made at the detriment of parked cell volume, haemoglobin concentration and red blood cell count.

Conclusion

It has been considered that sex has no significant influence on the blood indices of Japanese quails. Bodyweight was found to be good at estimating most of the haematological parameters. Also, other researchers should analyse blood indices at ages beyond six weeks to determine at what age sex exerts its influence on blood parameters in Japanese quails. Therefore, this study has shown that Japanese quails can be reared successfully in the southwestern part of Nigeria commercially without any adverse effect on the haematological parameters of the birds.

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