HAEMATOLOGICAL INDICES OF RABBITS FED GRADED LEVELS OF TWO FIBRE SOURCES

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ABSTRACT

The study was conducted to establish the relationship between packed cell volume (PCV) and other blood parameters of rabbits fed graded levels of fibre sources. A total of twenty-five weaner rabbits used for the study were randomly assigned into five dietary groups of five replicates. The study lasted for twelve weeks. The two dietary fibre sources used were Wheat Offal (WO) and Brewer's Dried Grain (BDG). Treatment A without fibre source was the control while treatments B and C contained W/O, treatments D and E contained BDG as fibre sources each at 30% and 60% levels of inclusion respectively.Two rabbits were randomly selected per treatment for slaughtering and blood collection at the end of the study. The blood parameters studied were: packed cell volume (PCV), erythrocyte sedimentation rate (ESR), red blood cells (RBC), white blood cell (WBC), haemoglobin concentration (HBC), lymphocytes (LYMN), neutrophils (NEUT), monocytes (MONO), eosinophils (EOS) and basophils (BASOPH). The blood parameters were subjected to correlation and regression analysis. The analysis revealed that correlation coefficient between PCV-HBC was perfect and highly significant ($P < 0.01$). It was also significant for PCV-ESR and PCV-RBC ($P < 0.05$) while the other parameters were not significantly different ($P > 0.05$). However, the study also showed that negative correlation existed between PCV-LYMPH, PCV-MONO and PCV-ESO. The three functions used for prediction in the study were linear, exponential and quadratic. Accuracy of prediction was best with quadratic function except for WBC where the accuracy of prediction was best with linear function. The result showed that the level of PCV was directly proportional to the level of haemoglobin and an increament in ESR, BASOPH and RBC led to corresponding increase in PCV of the animals. However, the level of WBC, NEUT, LYMN, MONO and EOS did not affect the level of PCV. This means that the level of these parameters in the blood were determined by the presence of foreign materials but not the level of PCV. The study therefore recommended that rabbits fed graded levels of fibre sources could be reared intensively as meat animals on commercial scale using W/O and BDG as fibre sources with no or minimal haematological disorders.

Key words: Relationship, rabbit, fibre, haematology and parameter

INTRODUCTION

Blood is a complex fluid containing large variety of dissolved suspended inorganic and organic substances (Stewart, 1991) or specialized circulating tissues and cells suspended in the intercellular fluid substance (Dellman and Brown, 1976) which circulates in the arteries, vessels and capillaries of man and animals (Kronfield and Mediway, 1975). The various functions of the blood are made possible by the individual and collective actions of its constituents – the haematological and biochemical components.

Blood examination gives the opportunity to ascertain the health status of animals and to investigate the presence of several metabolites and other constituents and helps detect conditions of stress, which can be nutritional, environmental or physical (Aderemi, 2004). Physiological parameters (hormones, heart rate, immune reactions), when considered in relation with other parameters (behavior, morbidity), can be used as a welfare indicator (Hoy and Verga, 2007). Although there are a lot of studies on blood parameters of various domestic animals, few data are available about hematological values of farm rabbits, since little or no attention has been paid to rabbits reared for meat production.

Generally speaking, both the haematological and biochemical blood components are influenced by the quantity and quality of feed and also the level of anti-nutritional elements or factors present in the feed (Akinmutimi, 2004). Biochemical components are sensitive to elements of toxicity in feeds. They can also be used to monitor protein quality of feeds. Haematological components of blood are also valuable in monitoring feed toxicity especially with feed constituents that affect the formation of blood (Oyawoye and Ogunkunle, 1998).

MATERIALS AND METHODS

Experimental site, animals and design

The study was carried out at the Teaching and Research Farm, Livestock section (Rabbit unit) of the Federal University of Technology, Akure (FUTA). Twenty-five weaner rabbits of mixed breed (NewZealand White, Californian and Chinchilla) were used for the study which lasted 12 weeks. They were distributed randomly into five dietary groups of five replicates in a completely randomized design experiment. Rabbits were housed individually per cage for ease of data collection. The diets formulated at FUTA feed mill contained 30% and 60% inclusion levels, each of the two different fibre sources used, which were Wheat Offal (WO) and Brewer's Dried Grain (BDG) while diet A (control) has no fibre source. The diets were made isonitrogenous and isocaloric as presented in Table 1.

Data collection

Two rabbits were randomly selected per treatment for slaughtering and blood collection at the end of the study. The blood parameters studied and used for the analyses were; packed cell volume (PCV), erythrocyte sedimentation rate (ESR), red blood cells (RBC), white blood cell (WBC), haemoglobin concentration (HBC), lymphocyte (LYMN), neutrophils (NEUT), monocyte (MONO), eosinophils (EOS) and basophils (BASOPH). The blood parameters were subjected to correlation and regression analysis using linear and non-linear functions (exponential and quadratic) on a special package for social scientists (V.10, SPSS Inc, USA).

$Y = a + bx$ ……….. i (linear)
$Y_1 = a_i e + bx$ ………. ii (exponential)
$Y_2 = a_2 + b_2x + C_2x^2$ …….. iii (quadratic)

Where Y, Y_1 and Y_2 are dependent variables (PCV), x represents the independent variables ESR, RBC, WBC, HBC, LYMN, NEUT, MONO, EOS and BASOPH
b and c were the regression coefficients associated with the independent variables when the independent variable is zero. Logarithmic transformation was performed on equation (ii) to fit the model with the variable data, resulting into this equation.

$\text{Log } 10^{y}{}_1 = \log 10^{a}{}_1 + bx$

Regression equations were determined for each variable. The relationships between PCV and the blood parameters were assessed. The coefficient of determination (R^2) was used to compare the accuracy of prediction. Measurement of each blood component was regressed against the PCV at week 12 using the three functions described in the study. In this case, PCV = Y, Y_1 and Y_2, ESR = X_1, RBC = X_2, WBC = X_3, HBC = X_4, LYMN = X_5, NEUT = X_6, MONO = X_7, EOS = X_8 and BASOPH = X_9.

RESULTS AND DISCUSSIONS

The haematological response of rabbits to the diets is as shown in Table 2. The result of the study showed that any of the linear, exponential or quadratic function could be used in describing the PCV-Blood parameter relationship in rabbits as seen in the equations below. The correlation coefficients between PCV and other haematological parameters were generally high and this corroborates the findings of (Bortolotti *et. al*., 1989) in New Zealand white laboratory rabbits. However, some negative

Table 1: Gross composition of experimental diets (g/100g)

Ingredients	Diets				
	A	B	C	D	E
Maize	49.40	19.40	6.15	32.80	17.30
Brewer's Dried Grain	-	-	-	30.00	60.00
Wheat offal	-	30.00	60.00	-	-
Fish meal	7.80	7.80	10.00	5.60	3.20
Palm Kernel Cake	39.10	39.10	20.15	28.00	15.80
Oyster shell	1.50	1.50	1.50	1.50	1.50
Bone meal	1.20	1.20	1.20	1.20	1.20
Salt	0.50	0.50	0.50	0.50	0.50
Growers premix	0.25	0.25	0.25	0.25	0.25
Lysine HCl	0.15	0.15	0.15	0.15	0.15
Methionine	0.10	0.10	0.10	0.10	0.10
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated CP	17.99	18.10	17.68	18.07	17.97
Calculated ME	2769.91	2300.71	2057.45	2489.51	2217.25
Calculated CF	10.04	16.26	19.06	10.43	10.65

CP = Crude Protein, ME = Metabolisable Energy, CF = Crude Fibre, PKC = Palm Kernel Cake, BDG = Brewery Dried Grain.

Table 2: Haematological response of rabbits fed graded levels of Wheat offal (W/O) and Brewer's Dry Grain (BDG)

	DIETS					
PARAMETERS	CONT	%WHEAT OFFAL		%BREWER DRIED GRAIN		
	A	B (30)	C (60)	D (30)	E (60)	LS
PCV (%)	34.00±2.83	28.00±5.66	35.00±2.83	36.00±1.41	33.50±0.71	**
RBC ($x10^{12}$/l)	474.5±61.52	405.50±38.89	481.50±45.96	455.50±70	450.50±20.51	NS
HBC (g/100ml)	11.35±0.92[a]	9.30±1.83[b]	11.65±0.92[a]	12±0.42[a]	1.15±0.21[a]	*
WBC ($x10^9$/l)	134±39.60	93±21.21	144±76.37	127±15.56	117±55.15	NS
ESR (mm/hr)	2.00±0.00	1.50±0.71	1.75±0.35	2.50±0.71	2.50±0.71	**
LYMN (%)	58±8.49	58.5±4.95	58.5±6.36	57±1.41	55±2.83	NS
NEUT (%)	24.50±3.54	23.50±2.12	25.00±1.41	25.00±1.41	27.00±1.41	NS
MONO (%)	14.50±4.95	16.00±2.83	13.50±4.95	15.50±0.71	16.00±4.24	NS
EOS (%)	2.00±0.00	1.50±0.71	2.00±0.00	1.50±0.71	2.00±0.00	NS
BASOPH (%)	1.00±0.00[a]	0.50±0.71[b]	1.00±0.00[a]	1.00±0.00[a]	0.00±000[c]	*

PCV = Packed cell colume, RBC = Red blood cell, HBC = Haemoglobin, WBC = White blood cell, ESR = Erythrocyte sedimentation rate, LYMN = Lymphocyte, NEUT = Neutrophils, MONO = Monocyte, EOS = Eosinophils, BASOPH = Basophils, * = Significant (P<0.05), ** = Highly significant (P<0.01), NS = Not significant (P>0.05). LS = Level of significance, CONT = Control.

correlations were recorded and this was in agreement with (Archetti *et. al.*, 2008) using commercial rabbits at post weaning stage. Haemoglobin concentration had a perfect correlation with PCV and was highly significant ($P < 0.01$) as presented in Table 3. The regression equation and R^2 for PCV using quadratic function in week 12 are as expressed:

$Y_2 = -8.82 + 0.16x_1 – 8.48E\text{-}03x_1^2$, $R^2 = 39.9$; $Y_2 = 123.80 + 13.10x_2 – 9.50E\text{-}03x_2^2$, $R^2 = 34.4$.
$Y = 86.87 + 1.09x_3$, $R^2 = 11.0$; $Y_2 = -0.14 + 0.34x_4 –1.94E\text{-}04x_4^2$, $R^2 = 99.9$.
$Y_2 = 141.27 – 5.17x_5 + 7.88E\text{-}02x_5^2$, $R^2 = 19.3$; $Y_2 = -20.72 + 2.75x_6 + -4.10E\text{-}02x_6^2$, $R^2 = 33.2$.
$Y_2 = -85.30 + 6.84x_7 + -0.11x_7^2$, $R^2 = 14.7$; $Y_2 = 8.47 – 0.44x_8 + 7.15E\text{-}03x_8^2$, $R^2 = 8.5$.
$Y_2 = -2.04 + 9.77x_9 - 4.60E\text{-}04x_9^2$, $R^2 = 29.5$.
Where Y= Linear function (PVC), Y_2 = Quadratic function (PCV), x_1 = ESR, x_2 = RBC, x_3 = WBC, x_4 = HBC, x_5 = LYMN, x_6 = NEUT, x_7 = MONO, x_8 = EOS, x_9 = BASOPH.

Table 3: Correlation analysis between PCV and other blood parameters at 12th week using simple linear, exponential and quadratic functions

	Linear		Exponential		Quadratic	
Parameter	PCV	LS	PCV	LS	PCV	LS
ESR	0.58	*	0.60	*	0.56	*
RBC	0.59	*	0.59	*	0.58	*
WBC	0.10	NS	0.38	NS	0.92	NS
HBC	1.00	***	1.00	***	1.00	***
LYMN	-0.31	NS	-0.33	NS	-0.28	NS
NEUT	0.46	NS	0.08	NS	0.43	NS
MONO	-0.05	NS	-0.02	NS	-0.08	NS
EOS	-0.03	NS	-0.45	NS	-0.01	NS
BASOPH	0.45	*	0.54	*	0.54	*

PCV = Packed cell volume, ESR = Erythrocyte sedimentation rate, RBC = Red blood cell, WBC = White blood cell, HBC = Heamoglobin, LYMN = Lymphocyte, LS = Level of significance, NEUT = Neutrophils, MONO = Monocyte, EOS = Eosinophils, BASOPH = Basophils, * = Significant (P<0.05), ** = Highly significant (P<0.01), NS = Not significant (P>0.05).

At the end of the experiment, estimate of parameters with quadratic function had theoretical advantage over the other functions with respect to its goodness of fit to the data except for X_3 (WBC) where linear function was favoured. In any case, a model may not necessarily be the best in all circumstances or with all data. The properties of the model and the data should be examined and appropriate model be chosen (Oni *et al*., 2001).

Variations in the functions best describing PCV-Blood parameter relationships in the study could be associated with differences in the production and maturation patterns of the different blood cell parameters and the presence or absence of stressors such as nutrition, weather condition and health status. Regression coefficients associated with variable X and unit change in Y is a positive value in the relationship between the PCV and other blood variables. This showed that the parameters were directly influenced by changes in PCV level. Therefore, the observation of positive regression values indicated that PCV level increases with increase in other blood components. This means that an increase in PCV was as a result of an increase in the other blood components except for WBC which had no influence.

CONCLUSION AND RECOMMENDATION

The study revealed that either a positive or negative relationship could exist between PCV and other blood parameters. The increase in other blood parameters led to increase in PCV level of the animals. This shows a better performance in the long run in terms of the quality of the meat that would be produced. It could then be recommended that rabbits fed graded levels of fibre sources could be reared intensively as meat animals on commercial scale using wheat offal and brewery dried grains as fibre sources with no or minimal haematological disorders. However, this is subject to further investigations which will certainly enable us to perform a more complete and detailed statistical analysis with a fairly larger sample size.

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