



HAEMATOLOGICAL AND SERUM BIOCHEMICAL INDICES OF BROILER CHICKENS FED FOUR DIFFERENT COMMERCIAL DIETS

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ABSTRACT

The study was conducted to determine the haematological and serum biochemical components of broiler chickens fed four different commercial diets. Two hundred and eight (208) day-old chicks were allotted to four diets in replicates of four in a completely randomized design (CRD). Each replicate had 13 birds and the diets were designated as A, B, C, and D. Feed and water were supplied *ad libitum* and the trial lasted for 42 days. Results for haematological indices showed no significant influence of the diets except for lymphocytes and basophils. Percentage lymphocytes was higher (P<0.05) on diet A (39.50%) which was statistically similar with diets B (38.75%) and D (34.75%) but lower in diet C (33.25%). Similarly, the level of basophils was higher (P<0.05) in diet D (3.50%) but statically similar to diets A (2.25%) and C (2.25%) and lower in diet B (1.00%). However, diet B did not differ statistically from diets A and C. None of the serum biochemical indices revealed any significant influence of diet. It was concluded that the four different commercial diets did not pose any health risk on broiler chickens and therefore are recommended for broiler production.

Keywords: Broiler, Haematology, Commercial, Feeds, Serum, Biochemistry.

INTRODUCTION

The poultry industry is widespread in Nigeria, largely due to the ease of raising poultry birds and their adaptability to the Nigerian environment (Olajide et al., 2020). It is an important sector of the economy that provides employment and supports the livelihoods of an estimated 65% of Nigerians (Endacott et al., 2021). Modern poultry production was introduced in Nigeria in the late 1950s (Ahaotu et al., 2017a) when it became clear the ruminant animal sector could not meet the increasing demand for meat. As at 2022, Nigeria ranked second in terms of poultry population, having a total 249 million bird (Statista, 2023). Despite being well-established, poultry production in Nigeria remains lower than that of temperate regions of the world. This could be attributed to various management factors, most outstandingly, nutrition. Poultry feed manufacturers play a significant role in ensuring that feeds meet the nutritional requirements of birds (Ahaotu et al., 2017b). Different classes of poultry have different nutritional requirements which must be met for efficient production. These requirements are basically divided into maintenance and production needs. For a broiler chicken to reach its maximum genetic potential for meat production, its feed must be nutritionally balanced. A deficiency in any particular nutrient would hinder economic production (Ononiwu et al., 2017).

Statutory organizations such as the Nigerian Institute of Animal Science in collaboration with the Standards Organization of Nigeria has established the nutritional needs of broiler chickens to guide the feed manufacturing industry. However, broiler chicken producers have reported reduced performance in terms of body weight gain when using





different commercial feeds. Previous studies have confirmed that some commercial feeds do not contained the required levels and proportions of nutrients (Babale *et al.*, 2016; Edache *et al.*, 2018; Dutta *et al.*, 2020; Abdullahi *et al.*, 2023). To further ascertain this claim, this study was designed to assess the haematological and serum biochemical constituents of commercial broiler chicken feeds sold in Bauchi metropolis. Haematological and biochemical studies are important because blood is the major transport system in the body. Therefore, whatever affects the blood will certainly affect the entire body adversely or moderately in terms of growth, maintenance and reproduction (Oke *et al.*, 2007). The study was therefore carried out to examine the effects of four different commercial feeds on haematological and serum biochemical indices of broiler chickens.

MATERIALS AND METHODS

Study Area

The experiment was conducted at the Poultry Unit, Teaching and Research Farm, Abubakar Tafawa Balewa University, Bauchi, Nigeria. Bauchi, is located within the southern guinea savannah on latitude 10.31 N and longitude 9.84 E. Furthermore, it is 616 metres above sea level characterized by two well-defined seasons; Rainy season (May - October) and dry season (November - April). The average annual rainfall is 1009 mm, highest relative humidity 94 % (August) and the lowest 35 % (February). Temperatures are between 13 – 17°C (December – February) and 36 – 37°C (March – April) (World Atlas, 2017).

Commercial Broiler Chicken Diets

Four different brands of commercial diets were procured from feed vendors in Bauchi. The diets were designated as A, B, C and D. Results for laboratory analysis of samples are presented in Tables 1 and 2.

Cinckens (Starter Thase)							
	Diets						
Parameters	Α		B	C D			
Crude protein (%)	22.80	22.00	23.00	22.00			
Crude fat (%)	4.00	5.00	5.50	4.52			
Crude fibre (%)	5.00	5.00	3.00	5.00			
Calcium (%)	1.00	1.00	1.20	1.00			
Available phosphorus (%)	0.50	0.45	0.50	0.50			
Lysine (%)	1.33	1.29	1.30	1.00			
Methionine (%)	0.60	0.58	0.56	0.80			
*Metabolizable energy							
(kcal/kg)	2900.00	3000.00	3050.00	3024.00			
*Coloulated according to Deven as (1095)							

Table 1: Chemical Composition of Four Selected Starter feed Fed to Broiler Chickens (Starter Phase)

*Calculated according to Pauzenga (1985)





	Diets					
Parameters	Α	В	С	D		
Crude protein (%)	20.00	20.00	19.50	20.90		
Crude fat (%)	6.00	4.80	5.50	6.40		
Crude fibre (%)	5.00	4.00	3.00	3.74		
Calcium (%)	1.25	1.20	1.20	1.84		
Available phosphorus (%)	0.40	0.45	0.44	0.65		
Lysine (%)	1.10	1.25	1.20	1.20		
Methionine (%)	0.55	0.50	0.50	0.52		
*Metabolizable energy						
(kcal/kg)	3024.00	3055.00	3100.00	2970.00		
*Calculated according to Dauzanga (1085)						

Table 2: Chemical Composition of Four Selected Finisher feed Fed to Broiler Chickens (Finisher Phase)

Calculated according to Pauzenga (1985)

Experimental Design and Management of Broiler Birds

Two hundred and eight day-old broiler chicks were brooded for two weeks and randomly allotted to four different commercial diets designated as A, B, C and D in a completely randomized design. Each diet was replicated 4 times with 13 birds each. Feed and drinking water were served ad libitum and the study lasted for 42 days.

Data Collection

At the end of each experiment, blood samples from 16 randomly selected birds, one per replicate, were collected to determine some haematological and biochemical parameters of the chickens. Prior to this, the birds were fasted overnight to avoid the temporary elevation of blood metabolites through feeding (Bush, 1991). Early in the morning, syringe and needle sets of 5 ml capacity and 21 gauge were used to draw blood (5 ml) from the left-wing veins.

Samples for haematological study were collected in properly labelled sterilized nonvacuum tubes containing a potassium salt of ethylene diamine tetra-acetic acid (K₃EDTA) as an anti-coagulant thinly spread along the inner walls while, samples for serological analysis were collected in plain non-vacuum tubes (K3EDTA-free). Blood samples were analysed for haematological parameters according to routine clinical methods (Baker et al., 1998).

The serum metabolites which include total protein, albumin, total cholesterol, bilirubin, glucose and urea were analysed using the UV Visible Spectrophotometer as described by Nicole et al. (2009). Biochemical constituents were calculated according to the manufacture's (Thermo Scientific, WI, U.S.A) instruction.

Data Analysis

Data collected were subjected to One Way Analysis of Variance (ANOVA) using IBM SPSS statistical pacage 30.0.0 for windows (SPSS, 2024). Means were separated using Duncan's Multiple Range Test (DMRT) of the same software at P<0.05 level of significance.

RESULTS AND DISCUSSION

Haematological Indices

Results for haematological parameters of broiler chickens fed four commercial diets is presented in Table 3. The result revealed that, except for some of the White Blood Cell differentials, no index was significantly affected. Packed Cell Volume ranges from 29.57 to 30.62% which is within the normal range (24.00-43.00%) as reported by Branson et al. (1994). Similarly, the concentration of Hb, RBC, eosinophils, basophils and MCHC were





within the normal ranges reported in literature (Jain, 1993 and Wikivet, 2024). This showed that the birds are neither anaemic nor dehydrated. However, the values obtained for WBC ($7.55 - 8.08 \times 10^3/\mu$ l) in this study are higher than $4.07-4.32 \times 10^3/\mu$ l reported by Wikivet (2024) for normal chickens. In contrast, values obtained for MCV (62.29-67.68 fl) are lower than (81.60-89.10) reported by the same authors. Lymphocytes (33.25-39.50%) was significantly (P<0.05) higher in diet A (39.50%) which is similar to 38.75% (diet B) and 34.75% (diet D) which did not differ from diet C (33.25%).

	Diets						
Parameters	Α	В	С	D	SEM	Ref. Values	
PCV (%)	30.18	29.76	29.57	30.62	0.87^{NS}	24.00-43.00 ^r	
Hb (g/dl)	10.45	9.10	9.98	10.16	0.43 ^{NS}	7.00-13.00 ^J	
RBC (x 10 ⁶ /µl)	4.64	4.78	4.78	4.62	0.26^{NS}	$4.21-4.84^{W}$	
WBC (x $10^{3}/\mu l$)	8.08	7.99	7.55	7.82	0.21 ^{NS}	$4.07-4.32^{W}$	
Neutrophils (%)	55.50	57.00	62.00	59.25	2.05 ^{NS}	-	
Lymphocytes (%)	39.50 ^a	38.75 ^{ab}	33.25 ^b	34.75 ^{ab}	1.84*	45.00-70.00 ^J	
Eosinophils (%)	2.75	3.25	2.50	3.25	0.26^{NS}	1.50-6.00 ^J	
Basophils (%)	2.25 ^{ab}	1.00 ^b	2.25 ^{ab}	3.5 ^a	0.42*	$1.00-5.00^{W}$	
MCV (fl)	65.22	62.39	62.87	67.68	4.50 ^{NS}	81.60-89.10 ^w	
MCH (pg)	22.66	19.15	21.37	22.47	1.99 ^{NS}	27.20-28.90 ^w	
MCHC (g/dl)	34.66	30.69	33.68	33.22	1.31 ^{NS}	26.00-35.00 ^J	

 Table 3: Haematological Indices of Broiler Chickens Fed Four Commercial

 Diets

a, b, = means within the same row with different superscripts differ significantly @ P<0.05, RBC = Red blood cell, WBC = White blood cell, MCV = Mean corpuscular volume, MCH = Mean corpuscular haemoglobin, MCHC = Mean corpuscular haemoglobin concentration, SEM = Standard Error of the Mean, NS = Not significant

^r = Branson *et al.*, (1994), ^J = Jain (1993), ^W = Wikivet (2024).

Serum Biochemical Indices

The result of serum biochemical indices of broiler chickens fed four commercial diets is presented in Table 4. None of the parameters revealed a significant effect of diet. Glucose level (7.97 – 8.55g/dl) was higher than the range of 2.00-5.00g/dl reported by Thrall (2007) for ringed-neck pheasant as well as for domestic chickens (Coles, 1977). In the same vein, total protein in the present study (6.96-7.28g/dl) was higher than 3.00-4.00g/dl reported by Meluzzi *et al.* (1992). However, albumin level was similar to the range of 1.17-2.74g/dl (Meluzzi *et al.*, 1992) for healthy chickens. Total protein is usually a reflection of the protein fed (Eggum, 1970) and higher values is an indication that protein levels in the diets were enough to meet the normal protein level in the birds' blood.

Similarly, serum cholesterol (7.26-7.43mg/dl) was slightly lower than the reference values of 8.70 -19.20mg/dl reported by Meluzzi *et al.* (1992).





	Diets					
Parameters	Α	В	С	D	SEM	Ref. Values
Glucose (g/dl)	8.55	8.02	7.97	8.11	0.18 ^{NS}	$2.00-5.00^{T}$
Total protein (g/dl)	7.11	6.96	7.00	7.28	0.16 ^{NS}	$3.00-4.00^{M}$
Bilirubin (g/dl)	15.36	14.76	1.16	14.95	0.22 ^{NS}	-
Albumin (g/dl)	2.79	2.69	2.93	3.03	0.13 ^{NS}	1.17 - 2.74 ^M
Urea (mmol/dl)	6.07	5.88	5.82	5.84	0.13 ^{NS}	-
Cholesterol (mg/dl)	7.43	7.26	7.28	7.36	0.19 ^{NS}	8.70-19.2 ^M

 Table 4: Biochemical Parameters of Broiler Chickens Fed Four Commercial Diets

Means within row with different superscripts differed significantly (P<0.05), SEM = Standard Error of the Mean, NS = Not significant. ^T= Thrall (2007), ^M= Meluzzi (1992)

CONCLUSION AND RECOMMENDATION

Based on the findings of this study, it was concluded that the four (4) commercial diets, A, B, C and D sold in Bauchi metropolis do not constitute any health risk to broiler chickens, thus can be used equally in broiler chickens production in the study area.

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