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DIGESTIBILITY AND HEMATOLOGICAL PARAMETERS OF BROILER CHICKENS FED BLOOD MEAL AS A REPLACEMENT FOR SYNTHETIC LYSINE

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ABSTRACT

An experiment was carried out to determine the effect of replacing synthetic lysine (SL) with blood meal (BM) on apparent nutrients digestibility and hematological responses of broiler chickens. One hundred and fifty (150) unsexed Anak broiler chicks were used. There were five diets with diet (T_1) containing 0.10% SL and without BM as control. Diets 2, 3, 4 and 5 contained 1.0, 2.0, 3.0 and 4.0% BM without SL respectively, representing T_2, T_3, T_4 and T_5 in the same order. The experiment was arranged in completely randomized design (CRD) with three replicates per treatment. Each treatment had 30 birds, 10 birds per replicate. Diets were isonitrogenous (23%CP and 20%CP) for starter and finisher phases and isocaloric (11.90MJME/Kg and 12.30MJME/Kg) for starter and finisher phases respectively. At the end of the experiment which lasted for 56 days (28 days for each phase), 4.0% BM significantly ($P<0.05$) reduced protein digestibility at both phases and 3.0% at starter phase only. Other nutrients digestibility and hematological parameters (white blood cells, red blood cells, hemoglobin and packed cell volume) measured were not significantly ($P>0.05$) different at both phases. There was no mortality recorded in all the dietary groups.

KEYWORDS: Lysine, blood meal, hematological, digestibility, broilers.

INTRODUCTION

Broiler chickens remain the fastest source of animal protein because of their rapid growth. This is due to their improved genetic make up, good nutrition and adequate management. This rapid growth may be hampered by poor nutrition emanating from poor feeds necessitated by high cost of feed ingredients. However, Uzegbu *et al*. (2007) noted that as the cost of the major feedstuff continues to progressively increase, there is still the need to maximize productivity. But maximization of productivity in broilers in form of heavy body weight with economical feed intake, is only achievable through the amount of good quality nutrients that are digested, absorbed and utilized by birds (Ndelekwute 2004).To achieve this, synthetic lysine is routinely added to chicken diets, because cereal grains and vegetable proteins which form the larger proportion of the diets contain limited lysine (D'Mello, 1993), and a major portion of the natural lysine in these plant feedstuffs are not available to the chicks (Prieto *et al*., 1994).However, since Odukwe and Njoku (1987) reported that synthetic lysine was imported and expensive in Nigeria this has not changed and increase in price has become more progressive currently. This may continue as local production of this essential feed ingredient is not yet in place. Therefore, to cushion this the need to look for feed ingredient that is available locally, less expensive that is good source of lysine is necessary. Blood meal is a good source of protein and lysine with 80% protein (Olomu, 1995) and 7% lysine (Donkoh *et al*., 1999). Blood used to prepare blood meal is available in sufficient quantity in Nigeria (Awonorin *et al*., 1991).

The objective of this study therefore was to compare the effect of replacement of 0.10% synthetic lysine with blood meal in broiler diets on nutrients digestibility and hematological parameters.

MATERIALS AND METHODS

Experimental Site

The experiment was conducted at the Teaching and Research Farm of College of Animal Science and Animal Production, Michael Okpara University of Agriculture, Umudike Abia State. Umudike is located at latitude $5^0 29^1$N and longitude $7^0 32^1$E in the rainforest zone of Nigeria with average relative humidity of 72%. It has average rainfall of 2000mm per annum with double maxima pattern.

Procurement and Processing of Blood Meal

Cattle blood used to process into the used blood meal was obtained from a government abattoir about 15km from the site of the experiment. The blood was cooked in a 30 litres capacity aluminium pot over a fire wood. It was allowed to boil for 20 minutes after which pot content was then transferred into a Hessian sack. The sack and boiled bloodwas pressed to reduce the water content. Blood lumps formed were then spread on a clean mat under the sun for drying. Mosquito net raised to one meter high was used to cover the spread lumps to avoid perching of flies on the lumps and hence to avoid contamination. It took three days to dry under average ambient temperature of 34 decrees Celsius. The dry blood was then ground into a meal. Proximate composition and amino acid profile of the blood meal were determined according to AOAC (1984) table 1.

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Experimental Diets

Five diets were produced using trial and error method (Olomu, 1995) for both starter and finisher phases. Diet 1 which contained 0.10% synthetic lysine without blood meal served as control. Diets 2, 3, 4 and 5 respectively contained 1.0, 2.0, 3.0 and 4.0% blood meal calculated to supply 0.07, 0.14, 0.21 and 0.28% bound lysine respectively without synthetic lysine. All diets were made isonitrogenous, 23% for starter diets and 20% for finisher diets, and isocaloric, 11.90MJME/Kg for starter and 12.30MJME/Kg for finisher diets as shown in table 2.

Experimental Chicks and Design

Completely randomized design (CRD) was used in this study. One hundred and fifty unsexed day old chicks of Anak Strain obtained from hatchery agent were used.The experiment started from day one. Birds were randomly grouped into dietary treatments with 30 birds per treatment. Each treatment was replicated three times with 10 birds per replicate. Brooding was the conventional floor system with stove as source of heat placed under a hover for each treatment. Birds were both fed and watered unrestricted, and were vaccinated against Newcastle and Gumboro diseases. Antibiotic drugs were periodically given as preventive measures.

Data Collection and Analysis

Digestibility Study.

At the end of each phase, fecal samples were collected from birds for digestibility studies. Five days to the end of each phase, two birds from each replicate of a treatment giving a total of six birds per treatment, were randomly selected and placed in metabolic cages according to replicates and treatment groups. A known quantity of feed (120g/ bird/ day and 200g/bird/ day) for starter and finisher respectively of their respective diets was given and daily feed consumption was noted. The first three days were used to condition birds for the new environment of cage housing, feeding and drinking system. Thereafter, total fecal collection was made for three days by means of clean plastic trays placed under the cages. Fecal samples collected were oven dried to constant weight at 60^{0c}. Proximate analysis was carried out accordingly to AOAC (1984) and results obtained were used to calculate apparent nutrient digestibility according to Maynard *et al*. (1981) as shown below.

$$\text{Nutrient Digestibility} = \frac{\text{Quantity of nutrient consumed - Quantity in feces}}{\text{Quantity of nutrient consumed}} \times 100$$

Hematological Study

Blood collection was by bleeding through the bronchial vein. Syringe was used to collect blood into bottles containing dipotassium salt of Ethylenediaminetetra acetic acid (EDTA) and agitated to mix well. This was to prevent coagulation. Blood was collected from birds at the end of each phase and analysis for red blood cells (RBC) and white blood cells (WBC) according to Maxwell (1981). The quantity of heamoglobin (Hb) and packed cell volume (PCV) were respectively determined by cyanmet haemoglobin and micro haemotocrit methods (Dacie and Lewis, 1995).

Data Analysis

All data collected and calculated were subjected to Analysis of variance according to Steel and Torrie (1981).Least significant different was used to separate significant means.

RESULTS AND DISCUSSION

Proximate composition and amino acid profile of the blood meal table 1 shows 80.35% protein and 7.05% lysine which are similar to Olomu (1995) and Donkoh *et al*. (1999) respectively. Nutrients content of diets table 2 are similar to Olomu (1995). Influence of diets on nutrients digestibility and hematological parameters as shown in Table 3 for both starter and finisher phases indicates that significant difference occurred only for nutrients digestibility. During starter phase, diet significantly ($P<0.05$) influenced protein digestibility, as blood meal negatively affected protein digestibility. Synthetic lysine group had better protein digestibility than birds feed 3.0 and 4.0% blood meal, but similar to 1.0 and 2.0% blood meal groups. Hence, synthetic lysine group was 6.7% better than 3.0% blood meal group and 7.09% in superiority than 4.0% blood meal group. Though there was no significant difference ($P>0.05$) in other nutrients digestibility, synthetic lysine group marginally performed better than blood meal groups except for energy utilization. At finisher phase only protein digestibility still remained significantly ($P<0.05$) different. However, considering the same protein digestibility, dietary influence changed. Though synthetic lysine group performed better (75.39%) than 4.0% blood meal (68.57%) it was similar ($P>0.05$) to 3.0% blood meal group (70.01). This showed some level of adaptation. Therefore it seems that protein in blood meal was better utilized during finisher than starter phase. It was closely observed that in both phases, there was somehow marginal but progressive decline in digestibility showing some level of influence of blood meal level within blood meal groups. It was also observed that digestibility was higher at finisher than starter phase, which agrees with Maynard *et al*. (1981) that older animals digest nutrients better than younger animals. This work agrees with Edney *et al*.(2005) and later concurred by Khawaja *et al.(* 2007) that blood meal reduced protein digestion at 4% inclusion level and above. Hurell (1990) attributed this to effect of maillard reaction due to heat of processing of blood meal.A look at the hematological parameters, show that there was no significant difference ($P>0.05$) for both phases. Values of parameters shows a pattern that indicates diet having no influence on the hematological parameters hence blood meal may have had no deleterious effect on birds. This agrees with Donkoh *et al*. (1999) who reported that 2.5 – 7.5% blood meal inclusion in broiler diets did not alter the composition of red blood cells, white blood cells, hemoglobin and packed cell volume. There were high values of hematological parameters at finisher than starter phase in consonant with Olusanya (1977) who reported hematological parameters of animals to increase with age.

In conclusion, the result of this study indicates that blood meal in diets for broilers can reduce protein digestibility at 4.0% level at both starter and finisher phases and

3.0% at only starter phase. This however, may be deduced from the fact that heat of processing might have affected negatively the protein quality, and also that crude protein from 4.0% blood meal constituted 13.50 and 15.45% of the protein of the diet for starter and finisher respectively. Nevertheless, 3.0% blood meal could be used in diets for broiler chickens in place of 0.10% synthetic lysine if protein digestibility is to be considered.

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Table 1: Proximate Composition and Amino Acid Profile of Processed Blood Meal

Composition	**%**
Moisture	8.67
Dry matter	91.33
Crude protein	80.35
Crude fibre	1.80
Ether extract	2.00
Ash	5.00
Nitrogen free extract	2.17
Amino Acids	
Lysine	7.05
Arginine	4.01
Methionine	1.30
Histidine	5.45
Phenylalanine	6.45
Leucine	10.8
Isoleucine	0.78
Tryptophan	1.35
Threonine	4.35
Alanine	0.70
Gross energy (MJ/Kg)	18.30

Table 2: Composition of experimental diets

	Starter					Finisher				
Ingredients (%)	1	2	3	4	5	1	2	3	4	5
Maize	50.0	50.0	50.0	50.0	50.0	53.0	53.0	53.0	53.0	53.0
Soyabean Meal	31.55	30.0	28.0	26.0	24.0	24.5	23.0	21.0	19.0	17.0
Palm Kernel cake	10.0	10.75	11.75	12.85	13.85	15.5	16.0	17.0	18.0	19.0
Fish meal	4.0	4.0	4.0	4.0	4.0	2.0	2.0	2.0	2.0	2.0
Blood meal	-	1.0	2.0	3.0	4.0	-	1.0	2.0	3.0	4.0
Palm oil	0.60	0.50	0.5	0.4	0.4	1.15	1.25	1.25	1.25	1.25
Bone meal	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Salt (Nacl)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	-	-	-	-	0.10	-	-	-	
Mathionine	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Premix*	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
Calculated Composition(%)										
Crude Protein	23.00	23.24	23.32	23.41	23.44	20.12	20.33	20.41	20.44	20.47
ME(MJ/Kg)	11.92	11.93	11.94	11.94	11.93	12.3	12.38	12.34	12.28	12.30
Crude fibre	3.60	3.67	3.68	3.76	3.79	4.30	4.38	4.61	4.80	4.85
Ether extract	5.51	5.4	5.37	5.26	5.23	6.60	6.40	6.20	6.0	5.96
Nitrogen free extract	48.80	48.72	48.65	48.14	48.04	50.10	50.0	50.25	50.20	50.20
Calcium	1.25	1.23	1.22	1.21	1.20	1.10	1.08	1.08	1.07	1.06
Phosphorus	1.05	1.03	1.03	1.02	1.02	0.90	0.89	0.87	0.88	0.87
Lysine	1.35	1.25	1.25	1.26	1.26	1.10	1.00	1.00	1.03	1.02
Methionine	***0.95***	***0.93***	***0.93***	***0.93***	***0.93***	***0.80***	***0.80***	***0.79***	***0.79***	

*Permix supplied (per kg diet) Vitamin A (15,000 IU), Vitamin D3 (3,000 IU),Vitamin E (30 I U), Vitamin K (2.5mg), Thiamin (2.0mg), Riboflavin (6mg), Pyridoxine (4mg), Niacin (40mg),Cobalamin (0.02mg), Pantothemic acid (910mg), Folic acid (1.0mg), Biotin (0.08mg), Chlorine chloride (0.05mg), Manganese (0.096g), Zinc (0.6g), Iron (0.024g), Copper (0.006g), Iodine (0.0014g), Selenium (0.24mg), Cobalt (0.024mg), Antioxidant (0.125g).

*Permix supplied (per kg diet), Vitamin A (10,000I.U), Vitamin D3 (2,00I.U), Vitamin E (20 IU), Vitamin K (2.0mg) Thiamin (2.0mg), Riboflavin (3.0mg), Pyridoxine (4.0mg), Niacin (20mg), Cobalamin (0.05mg), Panothemic acid (5.0mg), Folic acid (0.5mg), Biotin (0.08mg), Chlorine chloride (0.2g), Manganese (0.006g), Zinc (0.03g), Iron (0.05g), Copper (0.006g) Iodine (0.0014g), Selenium (0.24mg), Cobalt (0.25mg), Antioxidant (0.125g).

Table 3: Effects of dietary treatments on nutrients digestibility and hematological Parameters.

Starter	Diets					
Digestibility	1	2	3	4	5	Sem
Dry matter(DM) intake(g)	80.30	80.70	81.33	79.33	79.80	1.50^{ns}
Fecal dry matter(g)	20.00	20.33	20.10	23.00	23.33	2.35^{ns}
DM digestibility(%)	75.36	74.80	75.27	71.01	70.76	2.71^{ns}
Crude protein (%)	71.21^{a}	69.36^{ab}	69.02^{ab}	64.45^{b}	54.12^{b}	3.14*
Ether extract (%)	98.12	98.25	98.00	97.80	97.87	2.56^{ns}
Crude fibre (%)	19.98	20.15	20.98	18.47	19.27	2.16^{ns}
Nitrogen free extract (%)	90.10	88.67	89.29	86.99	86.46	3.25^{ns}
Energy utilization(%)	69.06	69.64	69.75	70.18	70.24	3.24^{ns}
Finisher						
Dry matter intake(g)	144.60	145.20	143.70	143.10	141.90	10.15^{ns}
Fecal dry matter(g)	27.60	30.00	30.00	30.50	31.20	3.12^{ns}
DM digestibility(%)	81.67	79.93	79.12	78.69	77.45	3.84^{ns}
Crude protein(%)	75.39^{a}	71.31^{ab}	70.96^{ab}	70.01^{b}	68.57^{b}	3.05*
Ether extract (%)	93.68	93.53	93.85	93.91	93.71	3.86^{ns}
Crude fibre (%)	34.67	32.23	31.73	31.00	30.44	2.23^{ns}

*Means along the row with different superscripts are significantly different (P<0.05)

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