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Research Article

Effect of two Commercial Broiler diets on Biochemical constituents of Broiler Chickens in Semi arid region of Nigeria

Babawuro Yahaya and Abba Yusuf

School of Vocational Education, Department of General Agriculture, Federal College of Education (Technical) Gombe PMB 060 Gombe, Gombe State Nigeria
***Corresponding author:** sarkinshanu2005@yahoo.com

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ABSTRACT

The study was carried out to evaluate the haematological constituents and biochemical parameters of broiler chickens fed two commercial poultry feeds, Masters Feeds (Treatment A) and ECWA Feeds (Treatment B), in the semi-arid environment of Borno state, northern Nigeria. Ninety six broiler chickens were used in the study for a period of nine weeks in a two by three completely randomized block design (CRBD). Broiler starter and finisher of the respective diets were fed to the chickens from 0-4 weeks and 5-9 weeks of age respectively. Feed and water were provided *ad libitum* throughout the experimental period. Results obtained from the study showed that parked cell volume (PCV) values for TA and TB were (34.1%) and (27.1%) while haemoglobin (Hb), red blood cell (RBC) and white blood cell (WBC) values were (11.5 g/100 ml) and (7.4 g/100 ml); 6.5 x 10^6 mm^3 and 3.9 x 10^6 mm^3 and 10.3 x $10^3/mm^3$, 5.6 x $10^3/mm^3$ (P>0.05) respectively. The mean corpuscle haemoglobin (MCH), mean corpuscular volume (MCV), and mean corpuscular haemoglobin concentration (MCHC) values in TA and TB were (17.2 Pg) and (18.7 Pg); (51.2 ul) and (30.35 ul); (39.3 g/dl) and (26.6 g/dl) respectively. However protein values for the two treatments were 30.9 mg/100 ml and 32.2 mg/100 ml while the blood albumin values were 19.75 g/dl and 18.75 g/dl respectively. There was no significant difference (P>0.05) in blood calcium values, TA 2.40 % and TB 2.38 % respectively. In general broiler chicks that consumed master feed (treatment A) recorded significantly (P>0.05) higher haematological constituents and biochemical parameters. Therefore Masters feed was recommended for the semi-arid zones of Nigeria. A follow up experiment to this study should evaluate the production parameters such as feed intake and body weight gain of the birds.

Key words: Broiler, Feeds, Semi-arid, Evaluation, Haematology, Constituents

INTRODUCTION

The world has witnessed an increase in human population of about 5.4 billion in 1990 which is expected to be about 9.5 billion in the year 2020; this will be mainly in the developing countries (FAO, 1995). Nigeria being a developing country is also among this population growth. Food security has been a serious problem in developing tropical countries. This has been aggravated by the increase in human population according to Vandjidk *et al.,* (1982). The world population has grown exponentially almost doubling in less than a century. According to Maraquiss (1985) the average protein intake in Nigeria is 6.5 g falling short to about 21.5 g from the 28 g/person/day by the British Medical Association recommendation.

Poultry meal especially broiler, provide man with nutrients for growth, tissue and weight control despite the fact that poultry keeping is a recent development in the tropical countries (Oluyemi and Roberts, 1988). Poultry industry is still in cradle as far as Nigeria is concerned which is as a result of revolution in poultry production, high cost and inadequate input in supply of maize which constitutes about 50% of poultry ration. Soya bean meal, groundnut meal, fish, lysine and price of finished feeds has become very exorbitant (Daniel, 1992). He also observed that despite all efforts to improve livestock production in Nigeria, animal protein is still in short supply. Broiler is a young chicken usually 9-12 weeks of age of either sex that is tender meated with soft, pliable, smooth textured skin and flexible breast bone cartilage with average weight of 1.5-2.5 Kg.

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Hucking *et al*. (2002) reported that broilers are usually raised in two stages, broiler starter and broiler finisher. The ration of the broiler starter is usually from day old to four weeks and broiler finisher is given from 4-9 weeks. According to Robert (1989), the thermoneutral zone of avian species lies within 18^{o}C and 26^{o}C, hybro was considered in the world as the most profitable broiler since growth per day has increased to 25% at the same time feed conversion has improved from 2.1-2.5.

There is probably no standard requirement that is adequate for all environmental conditions since feed consumption tend to lower by about 8-20% in the tropics than in temperate countries. Campbell and Husley (1990) reported that the recommendations in the temperate zones are less suitable for the tropics. Different reports on the nutrients requirement of broiler including that of (Freeman, 1975) who recommended 23-24% and 20-22% crude protein for broiler starter and finisher respectively.

Other extensive studies conducted in Nigeria on nutrients requirement of broiler in Nigeria and many parts of the world recommend 23-24% crude protein for the starter diet. This recommendation is similar to that in the United States, where (Philips, 2000) reported that broiler chicks of up to six weeks require crude protein of 23-30% for the finisher diet. Oluyemi and Robert (1988), observed that data obtained in southern humid and northern part of Nigeria tend to favour an optimum protein level of 23% with metabolizable energy (ME) of 2000-3000 kCal/Kg for both the broiler starter and finisher diet. Diambra and Cartney, (1989) fed isocaloric diets in the ration of broiler finisher in low temperate environment and observed that there is increased in feed consumption.

Haematology helps in determining and interpreting blood components, on the other hand, it helps in determining the level of anaemic condition of the animal. Blood chemistry is also important in determining and confirming the diagnosis of some diseases even though the health status of the animal may be difficult using medium than blood (Philips 2000). Haematology and biochemical parameters of blood constituent in birds have not so much been carried out in the semi-arid zone. Physiological status of birds has been postulated by (Brake and Thaxton, 1980) to be reflected in birds, body temperature, packed cell volume (PCV), Haemoglobin (Hb) concentration, total protein, plasma, total calcium, plasma inorganic phosphate and plasma glucose. Siegal and Gross (1980) observed that response to environment stresses by complex organisms such as birds was dependent on the integrative capacity of the nervous and endocrine system.

Therefore this study evaluated two commercial broiler feeds in semi-arid zone in Maiduguri Borno state northern Nigeria and its effects on haemoglobin constituents of broiler birds.

MATERIALS AND METHODS

The experiment was conducted at the University of Maiduguri teaching and research farm. Maiduguri is situated at latitude 11^{o}N, longitude 30^{o}E, and altitude of 354 m above sea level. Maiduguri is in the semi arid zone of northern Nigeria and falls within the sub sahelian zone of West Africa. It is characterized by hot and dry climate, short duration of rainfall (3-4 months) in a year and long period of dry season. The ambient temperature ranges between 15-44^{o}C. The rainfall varies from 150-600 mm and relative humidity between 5-43% (Alaku, 1983) extremes in weather condition is generally prevalent.

Experimental birds and management

A total of ninety six (96) day old hybro broilers were used for the experiment. Before the arrival of the birds, the brooder house was cleaned and washed. All the drinkers and feeders were properly washed and disinfected with antiseptic solution and sun dried. After the brooder house had dried, wood shavings were spread on the floor at a depth of 3-4 cm. Lamps and stoves were provided for the brooding. On the arrival of the day old chicks, their initial body weight were determined individually and later they were randomly assigned to two treatment groups. Each treatment contained forty eight (48) birds and was replicated three times. Anti stress was administered orally to alleviate the stress condition administered orally to alleviate the stress condition encountered from Jos to Maiduguri. Brooding lasted for three weeks. Feeders and drinkers were raised from the litter to avoid contamination. Gumboru and New castle diseases vaccination were administered at 2-3 weeks of age respectively and Gamboru vaccine was repeated at 5 weeks of age.

Experimental diets

The chicks were fed commercial diets, i.e. broiler starter and finisher of Masters (Treatment A) and ECWA (Treatment B) feeds. In treatment A, the chicks were fed with Masters starter diet during the first four weeks and later Masters finishers diet from 5-9 weeks of age. In treatment B, the chicks were fed ECWA starter feed for the first four (4) weeks with starter and 5-9 weeks with finisher. Daily temperatures were recorded every morning. The mean daily and weekly feed consumption per bird was normally determined by weighing the feed remnants and subtracting it from the amount given the previous day.

Analytical procedure

The Packed Cell Volume (PCV) was determined by a micro-haematocritic method, haemoglobin concentration was determined by cyma-haemoglobin method, erythrocytes, count was determined by placing the 4 ml of RBC diluting fluid into Bijou bottle.

Mean corpusclar volume (MCV) was determined by standard formula developed by (Swenson, 1970). The MCV is used to calculate average volume of single cell which is expressed inform of litter or in cubic mean.

$$MCV = \frac{PCV \text{ X } 10}{\text{No. of erythrocytes x } 10^{6} \text{mm}}$$

The mean corpuscular volume (MCV): the standard formula for determining the mean corpuscular volume (MCV) was also developed by (Swenson 1970). The MCV is used to find average volume of single cell expressed in form of litter or cubic mean

$$MCV = \frac{PCV \text{ x } 10}{\text{No. of erythrocytes x } 10^{6} \text{ mm}^{3}}$$

The mean corpuscle haemoglobin expresses the average haemoglobin content.

$$MCH = \frac{\text{Haemoglobin g/l x 10}}{\text{No. of erythrocytes x } 10^6 mm^3}$$

Mean Corpuscular Haemoglobin Concentration (MCHC)

The mean corpuscular Haemoglobin concentration was determined by the percentage of haemoglobin in all packed red blood cell (RBC).

$$MCHC = \frac{\text{Haemoglobin g/d x 100}}{\text{PCV \%}}$$

Biochemical analysis

The total protein was determined by burette method, serum albumin by Brown Cresol Green (BCG) and calcium by spectrophotometric method.

Chemical analysis

Proximate analysis of the experimental diet was carried out according to the method of AOAC (1990) while the crude protein was determined by Kjelhal method (AOAC, 1990).

RESULTS AND DISCUSSION

Environmental temperature and general performance

The average maximum and minimum temperature were recorded during the experiment (35-38^{o}C and 24^{o}C) respectively were outside the thermoneutral zone for domestic fowl reported by (Oluyemi and Roberts, 1988). The critical point of thermoneutral zone 18 (18^{o}C to 26^{o}C), high ambient temperature generally causes physiological and metabolic activities in most broilers more especially around the age of 7 weeks and above. In connection with this experiment, ambient temperature resulted in high mortality of birds in treatment A. The problem of ambient temperature in the house was tackled by providing enough drinking water and soaking of stressed birds in bowl of water to reduce the body temperature.

Packed Cell Volume (PCV)

The data shown in Table 2 have PCV value for TA (34.1%) which significantly (P>0.05) higher than of TB (27.1%). These values shows a similar trend in RBC and this low expected because of the relationship between PCV and RBC. (Swenson 1970) indicated that PCV values for avian species ranges from 30-40%. Treatment A is within the range while the mean PCV values obtained from treatment B is below the range. However PCV values for the two treatments falls within the range 20-40% recommended by Newell and Shefnew (1950) for chicks; the Hb values for the two treatments TA values greater than TB.

Haemoglobin Concentration (Hb)

The Hb values for the two treatments TA (11.5 g/100 ml), TB (7.4 g/100 ml) are presented in TA (11.5 g/100ml). TB (7.4 g/100 ml) are represented in Table 3. TA recorded significant (p>0.05) higher Hb values than TB. The normal Hb value for chicken is between 9-13 g/100 ml as reported by (Francis, 1998). The low Hb concentration agreed with the findings of (Swenson, 1970) who noted that low Hb concentration could be contributing factor for low heat expenditure that could limit oxygen consumption. Secondly, Hb values could be reduced as a result of deficiency induced in liacine production. The higher values recorded for TA can in part be attributed to the higher level of protein in Masters feed as compared to ECWA feeds.

Red Blood Cell (RBC)

From the mean values obtained from data in Table 3, RBC in TA and TB were 6.5 x 10^6 mm^3 and 3.9 x 10^6 mm^3 respectively. The RBC values for TA was significantly (P<0.05) higher than that of TB. The RBC obtained in the study falls within the range reported by (Freeman, 1975) with a range of 2 x 10^6 mm^3 for broiler chicken.

White Blood Cell

The data shown in Table 3 for treatment WBC in A and B have the following means: 10.3 x $10^3/mm^3$ and 5.6 x $10^3/mm^3$ respectively. (Freeman, 1975) observed that leucocytes count appear to be higher in wormer environmental temperature affects changes I the leucocytes reported by (Siegel and Gross 1980) and (El-Halawani *et al*., 1975), this result falls below the range.

Mean Corpuscular Haemoglobin (MCH)

The MCH values for TA (17.2 Pg) and TB (18.7 Pg) are shown in Table 3. The result indicated that there were no significant (p>0.05) differences between the two treatments. MCH is used to measure the size and haemoglobin content of RBC and values are very important in diagnosing anaemia (Fisher, 1994).

Mean Corpuscular Volume (MCV)

The mean values of MCV shown in Table 3 were (51.2 ul) and (30.35 ul) for TA and TB respectively. There was a significant (p<0.05) differences between the two treatments. However, TB recorded higher MCV values which might be due to low level protein in the broiler starter. The results obtained are below the range 115-125 ul as reported by (Swenson, 1970).

Mean Corpuscular Haemoglobin Concentration (MCHC)

The MCHC values were (39.3 g/dl) and (26.6 g/dl). TA values was significantly (p<0.05) higher than that of TB and was also within the recommended range of 28-36 g/dl (Kwari and Ubosi, 1989), whereas TB values is not within the range. MCHC gives the average percentage of the MCV that the Hb occupies (Deaton *et al*,. 1990). The MCHC level in the study did not seem to follow any particular trend, MCHC are indices.

Blood Protein

Total protein values for the two treatments were 30.9 mg/100 ml and 32.2 mg/100 ml respectively. There were no significant difference (p>0.05) between the treatment. The values obtained in this study were within the range 23-36 mg/100 ml by (Swenson 1970). This shows that the protein in the diet are similar and therefore the protein intake level across the groups are comparable.

Table 1: Chemical analysis of the experimental diets

Nutrients	Starter %		Finisher %	
	Masters	ECWA	Masters	ECWA
Dry matter (DM)	95.85	94.9	98.8	92.75
Moisture content %	4.15	5.1	4.2	7.25
Crude protein (CP)	20.17	14.61	15.48	16.76
Crude fibre (CF)	4.85	5.08	4.98	5.35
Ether extract (EE)	4.75	2.75	5	3.75
Ash	8.83	9.32	8.53	9.15
Nitrogen free extract (NFE)	62.1	68.22	66.76	63.09
Metabolized energy kCal/Kg	3335.13	3185.13	3348.81	3163.57

Table 2: Proximate composition of feeds (industrial)

Nutrients	Starter %		Finisher %	
	Masters	ECWA	Masters	ECWA
Protein	23	20	20	17.9
Calcium	1	0.84	1	0.82
Methionine	0.5	0.81	0.5	0.62
Lysine	1.2	1.03	0.9	0.82
Available phosphorus	0.75	0.42	0.5	0.41
Fat	5	-	5	-
Fibre	5	-	5	-
Metabolized energy kCal/Kg	2800	2930	2800	2700

Table 3: Haematological and Biochemical Analysis

Parameters	Diets (treatments)	
	TA	TB
PCV (%)	34.1	27.1
Hb g/(%)	11.5	7.4
RBC (10^3mm^3)	6.5	3.9
WBC (10^6mm^3)	10.3	5.56
MCV (f_l)	51.2	70.35
MCHC (g/d)	39.3	26.6
MCH (pg)	17.2	18.7
Total protein mg/mm	30.9	32.2
Ca %	2.4	2.1
Albumin (g/d)	18.7	19.7

Table 4: Average weekly temperature

Week	Maximum	Minimum
1	34.24[a]	24.21[b]
2	36.93[a]	25.76[b]
3	34.79[a]	25.07[b]
4	38.07[a]	24.57[b]
5	37.17[b]	26.21[a]
6	34.43[a]	24.21[b]
7	35.93	24.64
8	33.47	24.71
9	35.87	24.74
10	35.66±0.51	24.91±0.23

Blood albumin

Blood albumin values were 19.75 g/dl and 18.75 g/dl for TA and TB. There was no significant difference ($p>0.05$) between the treatments. This could be the reason why they have comparable total protein content between the different treatments. This agrees with the observation of (Anon, 1980) who reported that changes in protein reserve in animal as indicated by serum total protein to be associated with attention in the albumin fraction.

Calcium

Blood calcium values were 2.4% and 2.38 % for TA and TB respectively as shown in Table 3. There was no significant difference ($p>0.05$) between the two treatments A and B and were below the range 9-12% (Swenson 1970). This clearly shows that the diets have low calcium level which is consistent with the earlier report by Miller (1959).

Conclusion and recommendation

The results obtained from the study showed that treatments A, master feed recorded superior performance in terms of haematological constituents among the experimental birds, it is therefore recommended for broiler production. As a follow up experiment, the Masters and ECWA feeds should once more be evaluated during the cooler season of the year in the semi arid environment of Nigeria.

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