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Comparative Study of Wheat, Maize and Millet Offals on Haematological and Serum biochemical indices of Broiler Chickens

Maina[1] M., Benisheikh[2] A. A., Marte[2] A.M. and Mustapha[2] A.
[1]National Biotechnology Research and Development Agency (Bio-resource Development Center Dikwa)
[2]Department of Animal Production Technology, Ramat Polytechnic, Maiduguri, Borno State, Nigeria

Abstract: *An experiment was conducted to evaluate the haematological and serum biochemical indices of broiler chickens feed wheat, maize and millet offals in semi-arid region of Borno State. A total of 180 day- old broiler chicks were purchased for the study. The chicks were brooded for two weeks during which they were fed commercial broiler starter diet and then fed the formulated/ experimental starter diet from three to four weeks and experimental finisher diet from 5th to the 9th weeks. Experimental diets at the starter and finisher phases were formulated using locally procured feed ingredients which include maize, wheat offals, Maize bran, Millet bran, fish meal, bone meal, limestone, premix, methionine, common salt and lysine. Three starter and finisher diets were formulated with the same inclusion levels of 10% of brans. The diet was designated as: T1 (10% Wheat offals), T2 (10% maize bran), T3 (10% Millet bran) as shown in Tables 1 and 2. The experimental birds were allocated to the experimental diets in groups of 60 birds each and each treatment group was replicated four times with 15 birds per replicate in a completely randomized design (CRD). Four chickens were randomly selected from each treatment, that is, one from each replicate. Blood samples were collected through the wing veins using sterilized disposable 5 ml syringe and needle into sample bottles containing dipotassium salt of ethylene diamine tetra-acetic acid (EDTA) for haematological evaluation, while a second set of blood samples were collected into EDTA-free bottles for serum chemistry evaluation. The EDTA served as anticoagulant. The results revealed non-significant (P<0.05) difference in Haemoglobin (Hb), Means Corpuscular Haemoglobin Concerntrate (MCHC), Eosinophils, Bosophils and Monocytes among the treatment group on the hand, Pack Cell Volume (PCV), White Blood Cell (WBC), Red Blood Cell (RBC), Means Corpuscular Volume (MCV), and Means Corpuscular Haemoglobin (MCH) significantly (P>0.05) different with their treatment diet. The PCV of 26.00 – 28.50% observed in this study were fall within the normal range value of (25 – 45%) respectively by Banerjee (1998) for healthy chickens. The easionnophils and basophil value were within the normal range (0.00 - 5.00%). The results showed that total protein, Albumin, Potassium and Sodium were not affected (P >0.05) by the dietary treatments. On other hand, the Creatinine, Urea, biocarbonate, and glucose were Significant (P<0.05) Affected by the dietary treatments. With respect to this study, the chickens did not suffer from any problems that may result to anaemic conduction. Therefore, wheat maize and millet offals at 15% level were well tolerated by the broiler chickens.*

Keyboard: *Haematology, Serum biochemical, Broiler, Chickens, Wheat, Maize and Millet.*

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Background of the Study

Broiler chickens are specifically raised for meal production; they are noted for having very fast growth rate. A high feed conversion ratio, low level of activity. Broilers chickens reach a weight of 2kg at 8 or 9 weeks of age with a carcass yield of 65% as against about 50% for cattle, sheep and goat (Scott *et al.*, 2008). Feed account for as much as 60-80% of the total cost of production the replacement of one or more component of the feed will help reduce cost and improve productive has vital role in productive performance of poultry when added in their feed a little quantity. However, the use of some chemically based feed additive such as antibiotic and growth promoter have been widely applied by broilers industries which used to improve the health and productivity of chickens flocks, in which the different feed additives is used to support in having high and very fast growth of broilers but sometimes when not properly used in the correct quantity it may remain in the broiler product as residue or these are at least some perception among the consumers that broiler meat contains the residue which may give negative effect on consumer health problems (Scott *et al.*, 2008). Different workers have tried different level of diet for birds but most consistent result were obtaining at about 1% level and supplementation of this product. Beyond 1% of ration may also have negative effect on the overall cost of feeding? As a result, they are incorporated at level of 1% in the diet of broiler on the other hand, studies at their used as mixture in the birds' diet have produced inconsistent result.

Wheat, maize and Millet offal is all a by-product from wheat, maize and millet grain. It is used by livestock farmers inclusive of poultry, cattle rearers, and sheep and goat rearers. In other hand wheat, maize and Millet bran is suitable for livestock feeding and very palatable to most classes of animals. Wheat, maize and Millet offal are a major source of Fiber in broiler chicken diet's Wheat, maize and Millet offal is a good energy source for ruminants' animal especially during 5-7month of dry season in the northern guinea savanna zone of Nigeria (lesson, 2000). The objectives of the study are to determine the proximate composition of experimental diet, hematological and serum biochemical indices of broiler chickens fed experimental diet.

Materials and Method

Experimental Site

The study was conducted at the Livestock Unit of the Teaching and Research Farm, Department of Animal Production Technology, Ramat Polytechnic, Maiduguri. Maiduguri is located between latitude 11°5' and 12^0 North, longitude 13°09' and 14^0 East and at an altitude of 354 m above sea level (DNMA, 2013). The area has a semi-arid tropical climate with a wide seasonal diurnal range of temperature. The hottest months are April and May with a temperature range between 39.4 and 40.1 ^{0}C under shade (Afolayan *et al.,* 2013). There is a long dry season of 7 – 8 months between the months of October to May. The first three (3) months of dry season are characterized by the harmattan wind blowing from the Sahara Desert. During the last 2 – 3 months of the dry season, there is hot diurnal temperature and comparatively cooler nights. The average annual rainfall is about 500 mm.

Experimental Stock and their Management

A total of 180 day- old broiler chicks were purchased for the study. The chicks were brooded for two weeks during which they were fed commercial broiler starter diet and then fed the formulated/ experimental starter diet from three to four weeks and experimental finisher diet from 5th to the 9th weeks. The chicks were vaccinated against Gumboro disease at 2nd and 5th weeks of age and Newcastle disease at 3rd week of age. Feeding and watering were given *ad libitum* throughout the experimental period.

Experimental Diets and Experimental Design

Experimental diets at the starter and finisher phases were formulated using locally procured feed ingredients which include maize, wheat offals, Maize bran, Millet bran, fish meal, bone meal, limestone, premix, methionine, common salt and lysine. three starter and finisher diets were formulated with the same inclusion levels of 10% of brans. The diet was designated as: T1 (10% Wheat offals), T2 (10% maize bran), T3 (10% Millet bran) as shown in Tables 1 and 2. The experimental birds were allocated to the experimental diets in groups of 60 birds each and each treatment group was replicated four times with 15 birds per replicate in a completely randomized design (CRD). The study lasted for 7 weeks.

Table 1: Ingredients of the Experimental Broiler Starter Diets

Ingredient	T1 (Wheat offals)	T2 (Maize offals)	T3 (Millet offals)
Maize	45.93	44.95	45.27
Full-fat Soya bean meal	27.37	27.85	27.53
GNC	08.00	08.00	08.00
Wheat offal	10.00	-	-
Maize offal	-	10.00	-
Millet offal	-	-	10.00
Fish meal	05.00	05.00	05.00
Limestone	01.00	01.00	01.00
Bone meal	02.00	02.50	02.50
Min-vit-premix*	00.25	00.25	00.25
Methionine	00.10	00.10	00.10
Lysine	00.10	00.10	00.10
Table salt (NaCl)	00.25	00.25	00.25
Total	**100.00**	**100.00**	**100.0**
Calculated analysis			
Crude protein (%)	23.88	23.35	22.59
Crude fibre (%)	04.05	04.05	04.12
Ether extract (%)	03.90	03.88	03.67
Methionine (%)	00.45	00.44	00.43
Lysine (%)	01.39	01.38	01.36
Calcium (%)	01.00	01.00	01.00
Phosphorus (%)	00.65	00.65	00.65
ME (kcal/kg)	2854.16	2854.30	2940.93

ME= Metabolizable energy; GNC= groundnut cake

* = Bio Mix Broiler Premix supplying the following per Kg of feed:
Vitamin A=4,000,000IU, Vitamin D3=1,000,000IU, Vitamin E = 9,200mg, VitaminK3 = 800mg, VitaminB1 = 400mg, Vitamin B2 = 2200mg, Niacin=1,100mg, Pantothenic acid=3300mg, Vitamin B6 = 1200mg, Vitamin B12 =6mg Folic acid = 300mg, BiotinH2=24mg, Choline Chloride=1,200,000mg, Cobalt = 800mg, copper = 1200mg, Iodine=400mg, Iron=800mg, Manganese=16,000mg, Selenium=80mg, Zinc=12,000mg and Antioxidant=500mg

Table 2: Ingredients of the Experimental Broiler Finisher Diets

Ingredient	T1 (Wheat offals)	T2 (Maize offals)	T3 (Millet offals)
Maize	48.64	48.66	48.98
Full fat Soya bean meal	19.16	19.14	18.82
GNC	08.00	08.00	08.00
Wheat offal	15.00	-	-
Maize offal	-	15.00	-
Millet offal	-	-	15.00
Fish meal	05.00	05.00	05.00
Limestone	01.00	01.00	01.00
Bone meal	02.50	02.50	02.50
Min-vit-premix*	00.25	00.25	00.25
Methionine	00.10	00.10	00.10
Lysine	00.10	00.10	00.10
Table salt (NaCl)	00.25	00.25	00.25
Total	**100.00**	**100.00**	**100.00**
Calculated analysis			
Crude protein (%)	21.00	21.00	21.00
Crude fibre (%)	04.05	04.05	04.12
Ether extract (%)	03.90	03.88	03.67
Methionine (%)	00.45	00.44	00.43
Lysine (%)	01.39	01.38	01.36
Calcium (%)	01.00	01.00	01.00
Phosphorus (%)	00.65	00.65	00.65
ME (kcal/kg)	2954.16	2954.30	2940.93

ME= Metabolizable energy; GNC= groundnut cake

* = Bio Mix Broiler Premix supplying the following per Kg of feed:
Vitamin A=4,000,000IU, Vitamin D3=1,000,000IU, Vitamin E = 9,200mg, VitaminK3 = 800mg, VitaminB1 = 400mg, Vitamin B2 = 2200mg, Niacin=1,100mg, Pantothenic acid=3300mg, Vitamin B6 = 1200mg, Vitamin B12 =6mg Folic acid = 300mg, BiotinH2=24mg, Choline Chloride=1,200,000mg, Cobalt = 800mg, copper = 1200mg, Iodine=400mg, Iron=800mg, Manganese=16,000mg, Selenium=80mg, Zinc=12,000mg and Antioxidant=500mg

Blood Sample Collection and Haematological Indices Determination

Four chickens were randomly selected from each treatment, that is, one from each replicate. Blood samples were collected through the wing veins using sterilized disposable 5 ml syringe and needle into sample bottles containing dipotassium salt of ethylene diamine tetra-acetic acid (EDTA) for haematological evaluation, while a second set of blood samples were collected into EDTA-free bottles for serum chemistry evaluation. The EDTA served as anticoagulant. The birds were fasted overnight (12 hours) and bled in the morning (7:00 - 8:00am) to avoid excessive bleeding. The fasting of birds was done to avoid the temporary elevation of many blood metabolites by feeding.

Haematological parameters

The haematological parameters measured were: packed cell volume (PCV), red blood cells (RBC) count, white blood cells (WBC) count and haemoglobin (Hb) concentration. These were measured according to the methods outlined by Bush (1991). Calculation of the erythrocyte indices which include mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) was according to standard formulae (Schalm *et al*., 1975: Jain, 1986; Bush, 1991) as shown below:

$$MCV = \frac{PCV\ (\%)}{RBC\ (X\ 10^6/mm^3)} \times \frac{10}{1}$$

$$MCH = \frac{Hb\ (g/dl)}{RBC\ (in\ 10^6/mm^3)} \times \frac{10}{1}$$

$$MCHC = \frac{Hb\ (g/dl)}{PCV\ (\%)} \times \frac{100}{1}$$

Serum biochemical analysis

Total protein, albumin and globulin

The serum protein and albumin were determined by the method of Baker and Silverston (1985); globulin was estimated by the subtraction of albumin value from total protein value. The total protein and albumin in the serum were analyzed with Sigma assay kits (Sigma Chemical Co. St. Louis, Missouri, USA). The total serum protein and serum albumin were determined by Biuret reaction (Bush, 1975). The total serum protein was first estimated and then performing fractionation on further volume of the sample to precipitate and remove globulins; thus leaving only albumin in solution.

Serum urea

The serum urea estimation was carried out by the Diacetyl Monoxime method (WHO, 1980). Here the protein was first precipitated by trichloroacetic acid. The urea in the filtrate then reacted with diacetyl monoxime in the presence of acid, oxidizing reagent and thiosemicarbazide to give a coloured solution. This was then measured in a photoelectric colorimeter at a wave-length of 520 nm.

Urea Concentration (mmol/1) = AT/AR x 100(mg/dl)

Where;

AT = Absorbance of the test sample

AR = Absorbance of the reference sample

Serum cholesterol

This was determined by colorimetric enzyme method as outlined by Bush (1975). The method involves enzymatic hydrolysis and oxidation which terminates in the production of a red coloured solution. The concentration was determined after reading the colorimetric at 546 nm.

Serum glucose

The serum glucose was estimated by orthotoluidine method as described by WHO (1980). In this method, protein was first precipitated by trichloro-acetic-acid. The glucose in the filtrate will react with orthotoluidine reagent to give a green colour. This was measured in a photoelectric colorimeter at a wavelength of 630 nm.

Concentration of glucose (mmol/1) = AT/AR x 200(mg/dl)

Where:

AT = Absorbance of the test sample

AR = Absorbance of the reference sample

Serum creatinine

Standard sample of 100 µl was added to 2.0 ml of working reagent, mixed immediately, and a stop watch will be used. At 20 second the absorbance (A_0) of the clear solution was read and recorded by the data luster. At 80 seconds, a second reading, A_1, was recorded. The change in absorbance (ΔA) was obtained by subtraction of A_1 from A_0. Creatinine was then determined according to the formula of Monica (2010).

Creatinine Concentration = Δ A x Concentration of standard

Δ Standard (ΔS)

Where Δ A = change in absorbance

Δ S = change in standard

Chemical analysis

The chemical composition of the brans and experimental diets were determined according to AOAC (2000) methods.

Dry matter (DM) determination

Dry matter (DM) content of the samples were determined by weighing and oven-drying at 105°C for 24 h. After cooling and weighing, the procedure was repeatedly carried out until constant weight was obtained. The percentage moisture was calculated as follows: -

Moisture content (%) = $\frac{M1-M2}{M}$ x $\frac{100}{1}$

Where: M_1 = Initial weight of the Petridish + sample

M_2 = Final weight of the Petridish + sample

M = Weight of the sample used.

Crude protein (CP)

The crude protein content of the various feeds and faecal samples were determined by the Kjeldahl procedure (AOAC, 2000). This involves digestion, distillation and titration. The equipment used was the Kjeltech system manufactured by Tecator Ltd, Hoganas, Sweden.

Digestion

One gram of the sample was placed in a clean, dry digestion tube. One digestion tablet, which acted as a catalyst, was added. This was followed by adding 20 ml of concentrated Sulphuric acid (H_2SO_4). The digestion tube was heated on digestion block for several hours until all samples were completely digested, leaving a colourless solution. After cooling, the solution was diluted with 80 ml of distilled water to make it 100 ml.

Distillation

Using a pipette, 10 ml of the diluted solution was transferred into another digestion tube. The distillation was carried out in the distillation unit of the system (Kjeltech). Saturated boric acid solution (20 ml) containing bromocresol green and methyl red indicator was measured into a 250-ml conical flask. Sodium hydroxide (NaOH) solution (10 ml) was gently added down side of the digestion tube, which was immediately connected to the distillation chamber along with the conical flask. After 20 minutes of steam distillation the ammonia was released and collected in the boric acid.

Titration

The green distillate was titrated against 0.1N HC1 until neutral grey colour end point was obtained.

$$\text{Crude Protein (\%)} = \frac{(A-B) \times N \times 14.007 \times F}{\text{Mg of sample used}} \times \frac{100}{1}$$

Where:
A = Mole of acid for titrating sample
B = Mole of acid for titrating blank sample
N = Normality of acid used for titration
F = Conversion factor for feed material (6.25)

Crude fibre (CF) determination

One gram of prepared sample was weighed into a 500 ml conical flask and 100 ml of digestion reagent added. The digestion reagent was prepared by mixing 500 ml of glacial acetic acid, 450 ml of distilled water, 50 ml concentrated nitric acid and 20.0 g trichloro-acetic acid. The sample and the digestion reagent was put together into a flask for digestion. Digestion and refluxing lasted for 40 minutes and allowed to cool at a room temperature. The solution was filtered through a filter paper and hot water was used to wash it. Finally, petroleum ether was used to wash down the remaining fat. The remaining residue was transfered into a petridish and oven- dried overnight. The crude fibre was calculated as follows:

$$\text{\% Crude fibre (CF)} = \frac{\text{weight of fibre}}{\text{Weight of sample}} \times \frac{100}{1}$$

Ether extracts (EE) determination

Ether extract (EE) was determined using Soxhlet apparatus. Extraction of dried sample involves putting known quantity of sample into a thimble, plugged with cotton wool and placed in the extraction chamber with measured quantity of petroleum ether in the collection flask. The heating device was set to boil and reflux for 6 hours. Fat was collected in the flask and dried and weighed to obtain percentage by difference in weight. Ether extract was calculated as follows:

$$EE\ (\%) = \frac{W2-W1}{W} \times \frac{100}{1}$$

Where:
W1 = weight of the empty flask

W2 - weight of the flask + fat
W = weight of the sample used.

Ash determination

The percentage of ash was determined with muffle furnace. Empty crucible was dried, weighed and 2 g of the sample measured and burnt at 550°C to 600°C.

$$\text{Ash (\%)} = \frac{A1-A2}{A} \times \frac{100}{1}$$

Where: A1 = Weight of sample + crucible before ashing
A2 = Weight of sample + crucible after ashing
A = Weight of the sample used

Nitrogen-free extract (NFE) determination

It was determined by calculation as shown below:

NFE (%) = 100% - percentages of moisture (CP + CF + EE + Ash)

Statistical Analysis

All data collected were subjected to analysis of variance (ANOVA) using completely randomize design (CRD) (Steel *et al.,* 1997). Significant difference between the treatment means were separated and compared using Dunca;s Multiple Range Test (Duncan 1955). A computer package (Statistix 10.0) was used for the analysis.

Results and Discussion

Proximate Composition of the Starter and Finisher Diets

The results of the proximate composition of the experimental starter and finisher diets are presented in Tables 3 and 4. The metabolizable energy (ME) values of 2958.71 – 3163.89 kcal/kg and 3076.34 – 3470.70 kcal/kg for starter and finisher diets, respectively are in accordance with the reports of other workers (Aduku, 1992; Pfizer, 2001; NRC, 1994; Oluyemi and Roberts, 2000) whose recommendations ranged from 2800 – 3200 and 2800 -3300 kcal/kg for starter and finisher diets, respectively. Thus metabolizable energy values are adequate and can support the growth of the chicks at both phases.

The analysed Crude Protein (CP) values obtained from the study ranged from 22.23 – 23.24 and 19.33 – 20.00 % for starter and finisher diets, respectively. The values (22.23 – 23.24%) for starter diet is slightly lower than the 24 % CP recommended by Olomu (2011), but comparable to the 23 % CP reported by NRC (1994), for broiler starter. The CP values (19.33 – 20.00 %) obtained here for finisher are similar to the 20 % CP reported by Olomu (2011) for broiler finisher, but slightly higher than 18% CP recommended by NRC (1994).

The analysed Crude Fibre (CF) values of 4.08 – 5.00 % and 5.00 – 5.91 % for starter and finisher diets obtained from this study are within the range (4 – 5 % CF) recommended by Olomu (2011) for broiler chicken. According to Gonzalez-Alvarado *et al*. (2008), fibre content must be kept below 7 % in poultry feed.

Table 3: Proximate Composition of the Experimental Broiler Starter Diets Containing Wheat, Maize and Millet Offals

Nutrient (%)	Experimental Diets TI	T2	T3
Moisture	8.25	8.32	8.33
Crude protein (CP)	22.44	23.23	22.23
Crude fibre (CF)	4.34	4.08	5.65
Ether extract (EE)	5.55	8.43	7.65
Ash	5.23	5.46	6.56
NFE	50.71	54.33	52.77
ME (Kcal/kg)	3163.89	3104.12	2958.71

ME = Metabolizable energy
ME (Kcal/kg) = 37 x %CP + 81 x %EE + 35.5 x % NFE (Pauzenga, 1985)
NFE = Nitrogen-Free Extract

Table 4: Proximate Composition of the Experimental Broiler Finisher Diets Containing Wheat, Maize and Millet Offals

Nutrient (%)	Experimental Diets TI	T2	T3
Moisture	6.28	6.78	6.24
Crude protein (CP)	19.33	20.00	19.87
Crude fibre (CF)	5.00	5.76	5.91
Ether extract (EE)	8.26	7.65	6.76
Ash	6.26	6.40	6.43
NFE	50.13	49.14	47.21
ME (Kcal/kg)	3076.34	3470.70	3153.50

Metabolizable energy
ME (Kcal/kg) = 37 x %CP + 81 x %EE + 35.5 x % NFE (Pauzenga, 1985)
NFE = Nitrogen-Free Extract.

The values for ash were 5.23 – 6.56 % and 6.20 – 6.43 % for starter and finisher diets. These values can sufficiently provide the necessary minerals such as calcium and phosphorus for growth and development of bones and tissues and other physiological activities. The values are

similar with the reports of NRC (1994), and Oluyemi and Roberts (2000). The levels of nitrogen-free extract fall within the recommended levels reported by NRC (1994).

Ether Extract (EE) values obtained from the study are 5.55, 8.43 and 5.65 and 8.26, 7.65 and 6.76 % for both starter and finisher diet, respectively. The composition of the diets indicated that the nutrients profile of the diets is adequate for optimal performance of broiler chickens at all phases of growth.

Haematological Parameters of Broiler Chickens Fed with Wheat, Maize and Millet Offals.

Haematological Parameters of broiler chicken fed wheat, maize and millet offals are presented in Table 5. The results revealed non-significant (P<0.05) difference in Haemoglobin (Hb), Means Corpuscular Haemoglobin Concerntrate (MCHC), Eosinophils, Bosophils and Monocytes among the treatment group on the hand, Pack Cell Volume (PCV), White Blood Cell (WBC), Red Blood Cell (RBC), Means Corpuscular Volume (MCV), and Means Corpuscular Haemoglobin (MCH) significantly (P>0.05) different with their treatment diet. The PCV of 26.00 – 28.50% observed in this study were fall within the normal range value of (25 – 45%) respectively by Banerjee (1998) for healthy chickens. However, they above to the value of 24.33 – 26.33% and 22.70 – 26.16% respectively by Kwari *et al* (2019) for broiler chickens fed sickle pod (*Senna obtusifolia*) seed meal and shea butter cake, respectively. Mitruka and Rawnsely (1997) reported that when the PCV value are below the normal range, chickens may be likely be anaemic which invariably could be result in the alteration of others physiological processed such as assimilation and utilization if nutrients in this study, these adverse effects were not observed.

The Red Blood Cell (RBC) were within the range anon (1980). This is an indication of nutrients adequacy of the diets. Banerjee (1998) reported RBC values of 2 - 4 (x 106/mm3) as the ideal ranges for healthy chickens. The WBC value 9.60 - 15.00 observed from the study. Broiler chickens fed T2 15% maize offals recorded (P<0.05) higher than those fed 15% wheat offals T1 and 15% millet offals T3 respectively. According to Oyawoye and Ogunkunle (2004), haemotological component of blood are valuable in monetary level of toxicity in feed with emphasis on feed constituents that affects blood formulation.

The results of MCV and MCH revealed similar trend. Broiler chicken fed control diet (T1) recorded significantly (P>0.05) superior value of MCV and MCH and birds on (T2 15%) maize offals recorded inferior values of MCV and MCH. Broiler chicken fed (15% maize offals T2 and 15% millet offals T3) recorded similar values which are significantly (P>0.05) lower than group fed controls diet (15% wheat offals). The easionnophils and basophil value were within the normal range (0.00 - 5.00%) asreported by Anon (1980) for domestic chickens. Esionophils are known to phagocytize partice formed when an antigen and anti-bodies reacts, a strategy for combating disease infection by chickens (Adeyemo and Longe, 2007).

With respect to this study, the chickens did not suffer from any problems that may result to anaemic conduction. Therefore, wheat maize and millet offals at 15% level were well tolerated by the broiler chickens.

Table 5: Haematological Indices of Broiler Chickens Fed with Different fiber level

Parameter	T1(wheat offal)	T2(maize offal)	T3(millet offal)	SEM
Pack Cell Volume	28.00[a]	26.00[b]	28.50[a]	2.86 *
Haemoglobin	9.35	8.30	9.350	0.880 [NS]
White Blood Cell	10.10[b]	15.00[a]	9.60[b]	4.543*
Red Blood Cell	2.30[c]	5.25[a]	4.65[b]	1.924*
Means Corpuscular Volume	130.87[a]	46.68[c]	84.50[b]	38.39*
Means Corpuscular Haemoglobin	43.61[a]	15.84[c]	28.17[b]	12.77*
Means Corpuscular Haemoglobin Concerntrate	3.33	3.36	3.33	0.022 [NS]
Differential Count				
Lymphocytes	57.25[a]	34.40[b]	34.500[b]	23.56*
Eosinophils	3.80	3.90	4.80	1.649 [NS]
Basophils	1.55	2.80	0.75	1.355 [NS]
Monocytes	2.30	2.45	3.80	1.72 [NS]

NS = Not Significant (P > 0.05)
* = Significant (P < 0.05): SEM = Standard Error of Mean
a, b, c, d = Means within the same row bearing different superscripts differ significantly (P < 0.05)

Serum Biochemical Indices of Broiler Chicken fed with wheat maize and millet offal

Results of serum biochemical indices of broiler chickens fed wheat maize and millet offal's are presented in Table 6. The results showed that total protein, Albumin, Potassium and Sodium were not affected (P >0.05) by the dietary treatments. On other hand, the Creatinine, Urea, biocarbonate, and glucose were Significant (P<0.05) Affected by the dietary treatments. That total protein value falls within the range (5 -8 g/dl) reported by Jain (1986) for healthy chickens. The normal values for total protein and globulin are indication of adequate protein utilization. The normal values for total protein and globulin are reflection of better quality and amount of protein in the diets (Omoikhoje *et al.*,2004). Bush (1991) reported that an increase in total protein may be due to increase in the level of globulin while a decrease in total protein level is always due to a low albumin level.

The albumin values ranged from 3.55-7.05 g/dl are slightly above the reference value of 2-4g/dl reported by Jain (1986). Ewulola and Egbunike (2008) reported that values for serum albumin indicates adequacy in quality and quality of the dietary protein whereas value less than the normal physiological value indicate hypo albuminemia. Ewulola and Egbunike (2008) reported

that changes in nutritional protein status are better shown in albumin than in the globulin content of the blood.

The glucose levels of broiler chickens showed significant (P< 0.05) difference among the treatment group. The birds fed T3 (10% Millet offals) recorded superior values of glucose while the birds fed T2 (10% maize offals) recorded (P<0.05) least Values. Blood glucose, which is an end product of carbohydrate digestion is directly used to provide energy for the body. However, excess of it is being Converted and stored in the form of glycogen in the lives and muscle, and for fat, protein and other biosynthesis. The finding of Melluzi *et al*., 1991 Showed that low blood glucose could be an indication of inadequate intake of energy.

The values for urea are slightly above the acceptable range (4.25-4.55mmo/dl) for broiler chickens Jain, (1986). Serum Urea originated from the diet and tissue deamination of protein and

Table 6: Serum Biochemical Indices of Broiler Chickens Fed Wheat Maize and Millet offals

Parameter	T1(wheat offal)	T2(maize offal)	T3(millet offal)	SEM
Total Protein	6.400	6.85	6.80	3.65^{NS}
Albumin	5.150	3.55	7.05	1.60^{NS}
Creatinine	23.80^{c}	61.05^{a}	28.5^{b}	22.21^{*}
Urea	7.90^{a}	3.50^{b}	4.05^{b}	1.98^{*}
Biocabonet	21.700^{c}	40.150^{a}	32.10^{b}	4.49^{*}
Glucose	45.00^{b}	25.200^{c}	69.20^{a}	36.73^{*}
Potassium	6.100	7.050	5.65	2.22^{NS}
Sodium	107.00	64.910	86.95	46.68^{NS}

NS = Not Significant (P > 0.05)
* = Significant (P < 0.05): SEM = Standard Error of Mean
a, b, c, d = Means within the same row bearing different superscripts differ significantly (P < 0.05)

it's also indicates the quality Protein (Ewulola and Egbunike 2008). Ewulola and Egbunike (2008) reported that increase in urea Concentration is an indication of poor protein quality. Ani and Omeje (2008). Further explain that the values within the normal range imply that the dietary protein is well -utilized by the animal and this tallied with the results obtained in this study.

Serum creatinine values showed significant (P<0.05) difference among the treatment groups. Nworgu (2004) reported that the level of creatinine levels has been reported to be used as biochemical marker employed in the diagnosis of renal damage (Ojediran *et al*., 2012). The normal values obtained have further confirmed the nutritional adequacy of the dietary protein.

The values of potassium and sodium fall within the reference value reported by Jain. (1986). the results show that broiler chickens could tolerate wheat, maize and millet offal's without showing advance effects on serum biochemical parameters

Conclusion

The results of the study show that broiler chickens could tolerate wheat, maize and millet offal's without showing advance effects on heamatological and serum biochemical indices of broiler chickens, with respect to this study, the chickens did not suffer from any problems that may result to anaemic conduction. Therefore, wheat maize and millet offals at 15% level were well tolerated by the broiler chickens.

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