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Physiological evaluation of broiler finishers fed fermented bovine blood and rumen digesta meal

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Abstract

A 35-day feeding trial involving three hundred (300) five (5) week old broilers was carried out in a completely randomized design to evaluate the haematology, serum biochemical and gastro-intestinal characteristics of broiler finishers fed diets containing a mixture of fermented bovine blood and rumen digesta (FBBRD) meal at dietary levels of 0, 5, 10, 15 and 20 %, respectively. The birds were randomly grouped into five, with sixty birds each and four replicates of fifteen birds per treatment. At the end of the experiment, blood samples were collected from eight birds randomly selected from each treatment for haematological and biochemical analyses. The group on 10 % FBBRD diet had significantly (P<0.05) higher packed cell volume, haemoglobin concentration and red blood cells. Eosinophil values of birds on all the treatment groups except those on 5 % FBBRD dietary level were within the normal range. Serum biochemical analysis of the experimental birds recorded significant (P<0.05) differences in total protein, albumin, creatinine, cholesterol, except blood sugar concentrations. Serum concentrations of sodium and potassium of the experimental birds were also significantly (P<0.05) different. This study suggested that FBBRD meal when properly processed and at 10 % dietary level of inclusion, can be used in broiler finisher production without adverse effects on the physiological indices of birds.

Keywords: Physiological evaluation ,broiler finisher ,bovine blood rumen digesta.

Introduction

The high cost of feed ingredients, particularly the protein concentrates, and the competition for food between humans and animals has been a serious problem in developing countries (Adeniji and Balogun, 2002). This has led animal nutritionists to look for alternative, cheap and unconventional sources of feed materials, ranging from animal by-products to novel plants.

In the studies for the evaluation of blood-rumen content mixture in the diets of starter chicks, Adeniji and Balogun (2001) observed that birds on blood-rumen content-based diets had higher body weight gains and feed intake at 10 % level of inclusion than birds on the control diet. It has been reported (Dairo *et al*., 2005) that 30 % blood-rumen ration fed to growing rabbits exerted some adverse effects on the liver of these animals. However, in the diet of cockerels, Bashar *et al*. (2002) replaced wheat offal with blood rumen digesta meal up to 20 % dietary level, and observed no significant difference in growth performance of the birds, but the serum and biochemical characteristics of these birds were not determined.

Studies by Adeniji and Balogun (2002) had shown that bovine blood and rumen digesta could not successfully replace fish meal in layers diets, bzut the birds performed better in terms of weight gain than when fish meal was replaced with groundnut cake. Blend of

bovine blood and rumen digesta meal as a replacement for fish meal and groundnut cake in layer diets (Odunsi, 2003) is only beneficial in the reduction of cost of production.

There is little information on the effects of bovine blood and rumen digesta on physiological properties of broiler finishers. The present study was therefore designed with the main objective of determining the effects of incorporating fermented bovine blood and rumen digesta meals on the haematological and serum biochemical characteristics of broiler finishers.

Materials and Methods

Three hundred (300) five weeks old Hubbard broiler birds were used in the experiment which lasted for 35 days. The birds were divided into five groups of sixty birds each. Each treatment was further sub-divided into four (4) replicates of fifteen (15) birds each and housed in deep litter compartment measuring 12 x 10 m. The groups were then randomly assigned to five (5) experimental diets: 0, 5, 10, 15 and 20 % fermented bovine blood and rumen digesta (FBBRD) meal. Diets were isocaloric and isonitrogenous. The composition of the experimental diets is presented in Table 2. Routine poultry management practices were maintained throughout the trial period. Feed and water were given *ad-libitum*.

Bovine blood and rumen digesta were procured from the abattoir at Obinze, Imo State, Nigeria, following a hygienic procedure, in which clean disinfected containers were used for the collection. The blood and the rumen content were mixed in the ratio of 1:3 by volume, as recommended by Adeniji and Balogun (2001) and allowed to ferment for four days and then sun-dried for 4 – 5 days depending on the intensity of the sun. The mixture of fermented bovine blood and rumen digesta was flavoured with curry powder to mask the inherent offensive odour. The mixture was then ground in a hammer mill to produce dried fermented bovine blood and rumen digesta meal. Sample of the FBBRD meal was subjected to proximate analysis according to AOAC (1995) (Table 1).

Blood samples (5 ml each) were collected at the end of the experiment from eight broiler finisher birds per treatment, each into separate bottles containing ethylene diamine tetracetic acid (EDTA) for determination of packed cell volume (PCV), haemoglobin concentration (Hb), red blood cell count (RBC), white blood cell count (WBC) and differentials WBC. Standard procedures as outlined by Tuffery (1995) were followed in all analyses. A second set of bottles without EDTA were also used to collect more blood samples from the same birds for serum biochemical analysis of total protein, cholesterol, creatinine, blood sugar, sodium and potassium as outlined by Tweist and Smith (1970).

Table 1: Proximate analysis of mixture of fermented bovine blood and rumen digesta (%DM.

Parameters	Proximate composition
Moisture	7.20
Crude fibre	21.90
Crude protein	29.86
Ash	7.40
Ether extract	23.50
Nitrogen free extract	9.64

DM = Dry Matter

Table 2: Composition of experimental broiler finisher diets.

Ingredients	Dietary Levels (%				
	0.00	5.00	10.00	15.00	20.00
Maize	55.00	55.00	55.00	55.00	55.00
*FBBRD	0.00	5.00	10.00	15.00	20.00
Palm kernel cake	7.50	4.00	2.50	2.50	2.50
Soyabean meal	25.00	25.00	25.00	20.00	15.00
Fish meal	3.00	3.00	2.00	2.00	2.00
Bone meal	3.50	3.50	3.50	3.50	3.50
Wheat offal	2.00	0.50	0.50	0.50	0.50
Brewers Dried grain	3.00	1.00	0.50	0.50	0.50
**Vit/Min premix	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00
Chemical Analysis					
Crude protein	21.10	20.55	20.50	20.61	20.51
Crude fibre	5.70	5.90	6.00	6.04	6.34
Ether extract	5.19	4.64	4.38	4.10	4.00
Calcium	1.65	1.65	1.54	1.53	1.52
Phosphorus	0.91	0.91	0.85	0.82	0.72
ME (kcal/kg	2888.82	2881.05	2880.70	2835.00	2806.20

*FBBRD = Fermented bovine blood and rumen digesta

**To provide the following per kg of diet; Vit A, 10,000iu; Vit D2, 1,500iu; Vit E, 3iu; Vit K, 2mg; Riboflavin, 3mg; Vitamin B_{12}, 0.08mg; Folic acid, 4mg; Mn, 8mg; Zn, 0.5mg; Iodine, 1.0mg; Co, 1.2mg; Cu, 10mg; Fe. 20mg.

Data generated from the experiment were subjected to analysis of variance (ANOVA) as outlined by Snedecor and Cochran (1978). Significant differences ($P<0.05$) means were compared using Duncan's New Multiple Range Test (DNMRT) as outlined by Obi (1990).

Results

Haematological analysis of the experimental broiler finisher birds are presented in Table 3. The packed cell volume of all the treatment groups were below the reported range (Siegmund and

Table 3: Haematological values of experimental broiler finisher birds fed FBBRD meal

Parameters	Dietary Levels (%					
	0.00	5.00	10.00	15.00	20.00	SEM
Packed cell volume (%	26.00^{d}	28.00^{bc}	32.00^{a}	29.00^{b}	27.00^{bc}	0.50
Haemoglobin (g/dl	8.70^{d}	9.06^{b}	10.10^{a}	9.05^{b}	8.9^{c}	0.11
Red blood cells (ml/mm^3	3.93^{b}	4.00^{b}	5.30^{a}	4.00^{b}	3.50^{b}	0.18
Total White blood cells (x10^3/L	5.60^{c}	6.20^{ab}	6.10^{b}	6.30^{a}	4.80^{d}	0.13
Heterophils (%	46.00^{d}	52.00^{b}	52.00^{b}	60.00^{a}	50.00^{c}	1.16
Lymphocytes (%	54.00^{a}	46.00^{d}	48.00^{c}	38.00^{e}	50.00^{b}	1.45
Eosinophils (%	0.00	2.00^{a}	0.00	0.00	0.00	0.26
Monocytes (%	0.00	0.00	0.00	2.00^{a}	0.00	0.20
Basophils (%	0.00	0.00	0.00	0.00	0.00	0.00

SEM = Standard error mean

^{abcd} means within rows with different superscripts are significantly ($P<0.05$ different.

Table 4: Serum biochemistry of experimental broiler finishers fed FBBRD meal

Parameters	Dietary levels (% 0.00	5.00	10.00	15.00	20.00	SEM
Total protein (mg/dl	4.40[c]	4.29[d]	3.90[a]	4.80[a]	4.30[d]	0.06
Albumin (mg/dl	2.20[c]	2.20[c]	2.30[c]	2.80[a]	2.60[b]	0.06
Globulin (mg/dl	2.20	2.00	1.60	2.00	1.70	0.13
Creatinine (mg/dl	0.60[d]	1.10[b]	1.07[b]	0.92[c]	1.51[a]	0.11
Cholesterol (mg/dl	90.00[a]	90.00[a]	50.00[c]	70.00[b]	90.00[a]	5.61
Glucose (mg/dl	150.00[a]	86.00[c]	46.00[d]	120.00[b]	58.00[d]	0.58

SEM = Standard error mean
[abcd] means within rows with different superscripts are significantly (P<0.05 different.

Fraser, 1979) except the group on 10 % dietary level, which was significantly (P<0.05) higher than the other treatment groups. The values of Packed Cell Volume (PCV) increased from 26.00, 28.00 and 32.00 % for 0, 5 and 10 % dietary levels respectively, and then decreased to 29.00 % and 27.00 % for 15 % and 20 % dietary levels respectively. Haemoglobin concentration of the birds on 10 % dietary inclusion level was significantly (P<0.05) higher than the other treatment groups. There was significant difference (P<0.05) in Red Blood Cells (RBC) among the groups. The RBC values of the groups were 3.93, 4.00, 5.30, 4.00 and 3.50 ml/mm^3 for 0, 5, 10, 15 and 20 % dietary levels, respectively. The birds on 10 % dietary inclusion level recorded significantly (P<0.05) higher RBC values than other groups. There were significant (P<0.05) differences in WBC values for the groups. Birds on diets containing the test materials recorded higher WBC values than the control (0 %) group, except the group on the 20 % dietary level which was lower than the control. There were significant (P<0.05) differences in heterophil values among the treatment groups. The groups on the different levels of the test materials recorded significantly (P<0.05) higher values than the control (0 %) group. The group on 5 % dietary inclusion levels recorded significantly (P<0.05) higher value than the other groups. The group on 15 % dietary level recorded significantly (P<0.05) higher value of 2.0 % than the other groups for monocyte.

In the serum biochemistry of the experimental birds (Table 4), there were

Table 5: Serum electrolytes of experimental broiler finisher birds fed FBBRD meal

Parameters	**Dietary levels (% 0.00**	**5.00**	**10.00**	**15.00**	**20.00**	**SEM**
Sodium (mmol/L	5.50[e]	15.00[d]	28.00[b]	24.00[c]	34.30[a]	2.33
Potassium (mmol/L	3.60[a]	3.50[a]	3.00[b]	2.40[b]	2.40[b]	1.09

SEM = Standard error mean
[abcde] means within rows with different superscripts are significantly (P<0.05 different.

significant (P<0.05) differences in total protein among the treatment groups. The birds on 15 % dietary inclusion of FBBRD recorded the highest (P<0.05) values of albumin (2.80 mg/dl) followed by birds on 20 % dietary level of inclusion (2.60 mg/dl). No significant (P>0.05) difference was recorded in the globulin values of the birds. Creatinine values of the birds on 20 % dietary level of inclusion were significantly (P<0.05) higher than that of other groups. There were significant (P<0.05) differences in cholesterol values among the groups.

Serum electrolyte of the experimental broiler finisher birds fed FBBRD meal (Table 5) showed significant (P<0.05) differences among the treatment groups. Birds on 20% inclusion of FBBRD meal recorded the highest value of sodium (34.3 mmol/L) while the lowest value (5.50 mmol/L) was recorded by birds on the control diet. The highest value was recorded for potassium in birds fed 5% inclusion of FBBRD meal while birds on 15 and 20% inclusion of FBBRD meal recorded the lowest value of 2.40 mmol/L respectively.

Discussion

The high values of packed cell volume, haemoglobin and red blood cells which were relatively best at 10 % dietary level shows enhanced quality of blood. Higher PCV values have been correlated with the nutritional status of the animals (Iheukwumere, 2008). The white blood cells of the birds on the test material, except those on 20 % dietary level of FBBRD meal, were higher than the white blood cells of the birds on the control diet. The mean value of the white blood cell is within the range reported by Iheukwumere (2008) in broilers. At 20 % dietary level of FBBRD meal, the white blood cell count of the birds dropped below that of the control. The number could have decreased as a result of depletion from inflammatory infections. These findings are in agreement with the reports of Edoziem and Switzer (1997) in broilers. White blood cells are involved in antibody formation and cell mediated immunity (Iheukwumere and Odinamuo, 2009). The heterophil values obtained for the experimental birds suggest that FBBRD meal may not be beneficial to the birds above 10 % dietary inclusion, since high levels of heterophil count may be an indication of bacterial infection (Dein, 1986). The low eosinophilia among the treatment groups except those on 5 % dietary level indicate that parasitism was absent. The results of the haematological indices were similar between the treatment groups. This showed that 20% dietary level of FBBRD did not adversely affect blood formation in broiler finishers. The blood is of high physiological significance in the animal's body and any significant change could have resulted in limitation in the utilization of FBBRD in broiler diets. These findings are in line with reports of Sastry and Agrawal (1992).

The relative increase in the albumin level of the experimental birds with corresponding increase in total protein is an indication of good state of health, since its decrease below normal range is a common symptom of a pathological state (Kawai, 1973; Rodgers, 1994). The increase in albumin may also be as a result of protein intake being in excess of the amount required for growth and maintenance (Bowes *et al*., 1989). The birds on the test materials recorded higher creatinine levels than those on the control diet. Esonu *et al*. (2001) in a similar study attributed this to the quality and quantity of protein content in the diet. The cholesterol and glucose levels of the birds on the test material were relatively better than those of the control diet.

The absence of mortality during the

experimental period corroborates the non deleterious effect of FBBRD meal on the health status of broiler finishers.

Conclusion

The results of this trial suggests that up to 20% inclusion level of FBBRD meal could be tolerated by broiler finisher without any adverse effect on the birds, but for optimal performance 10% inclusion level is recommended.

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