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ORIGINAL RESEARCH ARTICLE

Effect of enzyme supplementation on haematology and serum biochemistry of broiler finishers fed cassava peel meal based diets

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ABSTRACT

A 28-day feeding trial was carried out to evaluate the effect of dietary enzyme supplementation on the haematological and serum biochemical characteristics of broiler finishers fed graded levels of cassava peel meal (CPM) based diets. Four experimental diets were formulated in which enzyme supplemented CPM replaced maize at 0, 25, 50 and 75% as T_1, T_2, T_3 and T_4 respectively. Two hundred chicks were allotted to the four dietary treatments with five replicates of ten (10) birds each in a completely randomized design. The diets were offered to the respective birds with clean water at ad-libitum. At the end of the feeding trial, four birds were randomly selected per replicate for haematological and serum biochemical determinations. Packed cell volume, haemoglobin, white blood cells, red blood cells, total protein, albumin, globulin, creatinine, cholesterol and glucose were determined. Results showed that all blood metabolites were significantly affected ($p<0.05$) among the treatments except for WBC, globulin, creatinine and cholesterol. This showed that the enzyme supplemented-CPM did not depress the fighting ability of the body system of the birds. It is therefore recommended that enzyme supplemented-CPM can be used to replace maize up to 50% in diets of broiler finishers without any deleterious effect on their blood characteristics.

Keywords: feed additive, agro-byproduct, blood parameters, chickens

INTRODUCTION

Maize constituted the highest proportion of most compounded ration for livestock especially monogastric animals taking about 50-60% of such diets (Akande and Lamidi, 2006). The usual high inclusion of maize translates into high cost of feed because of seasonality of production and competition for maize by man (Agbede *et al*., 2002). Any effort to substitute maize with cheaper feed ingredients is likely to reduce the total cost of production significantly (Okah, 2004; Akinmutimi, 2004). One of such alternatives for partial replacement of maize in animal diets is the cassava peel meal (Tewe and Kasali, 1986; Abu and Onifade, 1996; Ikurior and Onuh, 1996; Eruvbetine *et al*., 1996; Salami, 1999 and 2000). Cassava peel is the outer cover of the tuber which is discarded as a waste, hence, its posing a problem of health hazard to humans. The use of cassava peel at increased levels in monogastric ration will be a significant boost to the livestock feed industry (Iyayi and Yahaya, 1999). However, Cassava peels contain toxic levels of cyanogenic glucoside which is the major limitation to the use of cassava products and its by-products. Besides, it has been found that the peels also contain moderate to high levels of non-starch polysaccharides (NSPs) which, apart from being resistant to the digestive enzymes, also reduce digestibility of other dietary components (Iyayi, 1991; Iyayi and Yahaya, 1999).

Enzyme supplementation may be useful in reducing the depressing effect of cassava peel meal since it is known to counteract these adverse effects and also improve the productive value of fiber feed stuffs (Acamovic, 2001; Iyayi, *et al.*, 2005; Obadina, *et al.*, 2006; Balamrugan and Chandrasekaran, 2009, Augustine *et al*., 2011). Enzymes allow the use of wide range of ingredients without compromising bird's performance and hence provide great flexibility in least cost formulation (Han, 1997). Maxigrain is an exogenous enzyme that contain blend of most relevant digestive enzymes that served the aforementioned benefits. The enzymatic profiles of Maxigrain enzyme contain both non-soluble polysaccharides (NSPs) enzymes and phytase that brings about efficient utilization of wide range of agro-industrial by-products like cassava peel meal (CPM). Therefore, this study aimed to evaluate the hematological and serum biochemical indices of broiler finishers fed cassava peel meal based diets with dietary enzyme (Maxigrain®) supplementation.

MATERIALS AND METHODS

Experimental site: The research was conducted at the Teaching and Research Farm of Federal College of Wildlife Management, New Bussa, Niger state.

Experimental birds and management**:** A total of two hund`red day old broiler chicks were used for this experiment. The chicks were brooded and managed for four weeks and thereafter, randomly allocated to four dietary treatments in a completely randomized design of five replicates of ten (10) birds each. Deep litter system was used with wood shavings as litter material. Heat and ventilation were provided as necessary during the experiment. The birds were fed with the experimental diets for a period of four weeks and clean water was provided to the birds at *ad libitum*.

Experimental diets: Four experimental diets were formulated. The diets contained graded levels of cassava peel meal (CPM) to replace maize at 0, 25, 50 and 75% as T_1, T_2, T_3 and T_4 respectively. The gross composition of the experimental diets is presented in Table 1.

Haematological and serum biochemistry analysis: At the end of the 4th week of feeding trial, blood samples were randomly collected from four (4) birds per replicate. 2mls of blood was collected from the wing vein of randomly sampled birds into labeled sterile universal bottles containing anti-coagulant (ethyl diamine tetra acetic acid, EDTA) to determine haematological indices within 2 hours of blood collection such as Packed Cell Volume (PCV) (%), Red blood cells (RBC), White blood cells (WBC) and Haemoglobin (Hb). Another 2mls of blood was collected without anticoagulant into the sterile test tube for determination of serum biochemical indices. The tube containing blood was placed in slanting position at room temperature for clotting. Blood samples were centrifuged at 3000rpm for 10 minutes and thereafter stored at -20^{o}C to determine the concentration of serum total protein, globulin, albumin, creatinine, glucose and cholesterol. All analysis followed the procedure described by Ewuola and Egbunike (2008).

Chemical and statistical analysis: Proximate composition of cassava peel and the experimental diets were analyzed using the procedure described by A.O.A.C (2006). Data collected were subjected to analysis of variance (ANOVA) according to SAS (2009) and significant means were separated using Duncan's Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

The results of proximate analysis of cassava peel and the experimental diets are presented in Table 2. Also, results of haematological and serum biochemical indices are summarized in Table 3 and 4 respectively. The effect of dietary treatment on haematological examination showed that there were significant differences ($P<0.05$) among treatments for PCV, Hb and RBC. However, WBC of birds did not differ significantly ($P>0.05$) among the treatment diets.

Table 1: Gross composition of experimental broiler finisher diets

Ingredient	T_1 (0% CPM)	T_2 (25% CPM)	T_3 (50% CPM)	T_4 (75% CPM)
Maize	59.00	45.70	30.40	15.10
CPM	0.00	15.30	30.60	45.90
Soybean meal	28.00	28.00	28.00	28.00
Wheat offal	6.00	4.00	4.00	4.00
Fish Meal	3.00	3.00	3.00	3.00
Bone meal	2.00	2.00	2.00	2.00
#Premix	0.30	0.30	0.30	0.30
Salt	0.20	0.20	0.20	0.20
Lysine	0.20	0.20	0.20	0.20
Methionine	0.30	0.30	0.30	0.30
Maxigrain	0.00	0.01	0.01	0.01
Total	100	100	100	100
Calculated analysis				
Crude protein (%)	21.48	20.84	20.33	19.92
ME (kcal/kg)	3258.36	3133.13	3085.20	3038.30

#Vitamin-mineral premix contains the following: Vitamin A,15000000i.u; Vitamin D3 3,000000i.u, Vitamin E, 30,000i.u, Vitamin K, 2,500mgr, Thiamin, B1,2,000mgr, Riboflavin, B2, 6,000mgr;Pyridxine B6 4,000 Niacin, 4,000mgr; Vitamin B12,20mgr; Pantothenic Acid,10,000mgr; Biotin,80mgr;Cholin Chl0ride 500mgr; Antioxidant, 125gr;Manganese 96gr; Zinc, 60gr; Iron 24gr; Copper 60gr; Iodine 1.4gr;Selenim 240gr; Cobalt 120gr.

Table 2: Proximate composition of experimental broiler finisher's diets

Nutrient (%)	T_1 (0%CPM)	T_2 (25% CPM)	T_3 (50% CPM)	T_4 (75% CPM)	**CPM**
Dry matter	90.72	90.20	90.41	90.64	88.55
Crude protein	20.76	19.95	19.38	18.98	6.70
Crude fiber	3.65	5.48	7.53	9.38	14.83
Ether extract	3.80	3.68	2.98	2.57	1.75
Ash	4.85	5.20	5.93	6.36	5.68
NFE	66.92	65.73	64.18	62.71	71.04
ME (kcal/kg)	3354.42	3272.59	3139.59	3038.69	2911.74

It was observed that the inclusion of enzyme supplemented CPM in the diets caused reduction in the Hb and PCV concentration of the birds as the levels of CPM increases. This revealed that haemoglobin production in chickens may be more favorable by enzyme supplemented CPM based diets so also the PCV although their values for birds on higher proportion of CPM were still within the normal range suggested by Mistruka and Rawnsley (1977). The WBC was not affected by the dietary treatments thereby indicating that no pathological effect was induced by the enzyme supplemented CPM inclusion in the diets hence the health status of the birds were normal. The values for PCV, Hb, WBC and RBC of birds fed enzyme supplemented CPM diets were significantly higher at 50% CPM level of inclusion and were comparable to those on control diet. This indicated that enzyme supplementation has a positive effect on all the haematological parameters investigated which invariably has enhanced effect on the health of birds (Udoyong *et al*., 2010). Haematology is an index and it reflects the effect of dietary treatments on the animals in terms of type and quantity ingested and available for the animal to meet its physiological, biochemical and metabolic requirements (Ewuola *et al*., 2004).

The result of serum biochemistry revealed a significant variation ($p<0.05$) except for serum globulin, creatinine and cholesterol which did not differ significantly. The highest value of total protein was obtained in the birds fed diet T_3 (50% CPM), suggesting good quality protein of this diet (Eggum, 1980). The highest value of serum globulin was also recorded in T_3; similar trend was also observed with serum albumin. This is in agreement with the report of Babatunde and Oluyemi (2000), that the higher the value of serum globulin, the better the ability to fight against diseases. The relative higher value in the albumin level of bird on T_3 diet with corresponding increase in total protein was an indication of good state of health of the birds, since they form vital components of hormones, co-enzymes and phospholipids. The increase in total protein and albumin concentration of birds fed enzyme supplemented CPM may be as a result of better protein intake due to the hydrolylic effect of enzyme on non-starch polysaccarides (NSPs) and protein-bound tannin respectively as well as detoxification of cyanide (Annison and Choct, 1991, Iyayi and Losel, 2000; Udoyong *et al* 2000). Creatinine is a product of creatinine phosphate breakdown in the muscle, which is usually produced at a fairly constant rate by the body depending on muscle mass and the major source of excess creatinine in the blood of animals is from muscle when wasting occurs and creatinine phosphate is catabolized (Yuegang *et al.*, 2008). The lower values obtained reveals that no muscular wastage which might have been possibly caused by inadequacy of protein in birds. This is in accordance with the report of Udoyong *et al*., (2010). High values of cholesterol were recorded in T_1 and T_2 whereas lower values were recorded in T_3 and T_4. This showed that enzymes supplemented CPM have a reducing effect on cholesterol level on tissue. This could be attributed to enzyme hydrolytic effect on associated fiber levels in the diets, since cholesterol level consistently reduces in the blood of birds fed degraded fibrous feed due to slight reduction in lipogenesis (Ozung *et al*., 2014).

Table 3: Haematological indices of broiler finishers fed enzyme supplemented cassava peel meal based diets.

Parameters	T_1 (0%CPM)	T_2 (25% CPM)	T_3(50% CPM)	T_4 (75% CPM)	SEM
PCV (%)	30.45^a	24.7^b	26.9^a	21.25^b	1.06
Hb (g/dl)	10.10^a	8.20^{ab}	8.95^a	7.10^b	1.39
WBC ($x10^9$/L)	9.65	10.25	9.88	8.06	4.97
RBC ($x\ 10^{12}$/L)	8.02^a	6.51^b	7.82^a	5.92^b	0.89

a,b. Means with the same superscript in the same row are not significant ($P>0.05$)

Table 4: Serum biochemistry of broiler finishers fed enzyme (Maxigrain) supplemented cassava peel meal based diets

Parameters	T_1 (0%CPM)	T_2 (25% CPM)	T_3 (50% CPM)	T_4 (75% CPM)	SEM
Globulin (g/dl)	2.35	2.35	2.75	2.35	0.1
Albumin (g/dl)	3.55^{b}	4.10^{b}	5.00^{a}	3.80^{b}	0.22
Total protein (g/dl)	5.90^{b}	6.45^{b}	7.75^{a}	6.15^{b}	0.20
Creatinine (mg/dl)	2.43	2.36	2.40	2.44	1.21
Glucose (mg/dl)	233.44^{a}	215.05^{ab}	208^{b}	206.50^{b}	0.54
Cholesterol (mg/dl)	78.00	78.88	75.78	74.68	0.94

a,b: Means with the same superscript in the same row are not significant (P>0.05).

Reducing effect is particularly helpful to humans that are very conscious of cholesterol intake. A significant reduction was observed in serum glucose as the levels of enzyme supplemented CPM increases. This showed that serum glucose was lower with CPM inclusion because the ME value of CPM is lower than that of Maize.

CONCLUSION

The results of this study have shown that enzyme supplemented CPM replacing maize in finisher birds had no adverse effect on blood constituents of finisher broilers. The haematological and serum biochemical variables of birds fed 50% enzyme supplemented-CPM were quite promising comparable to the control. Therefore, using enzyme supplemented-CPM at inclusion rate of 50% is recommended to the diets of broiler finishers without any fear of detrimental effect on blood characteristics.

CONFLICT OF INTEREST

The authors declare that they have no conflicting interests**.**

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