Nigerian J. Anim. Sci. 2017 (1):135 - 143

Growth performance, blood parameters and carcass characteristics of broilers fed corn bran based diets with or without enzymes (Maxigrain®) supplementation.

Owosibo, A.O[1], Odetola, O.M[1], Okere I. A.[2] and Odejide, J.O[3]
[1]Federal College of Animal Health and Production Technology, P.M.B. 5029, Moor Plantation, Ibadan, Nigeria.
[2]Livestock Improvement Programme, Institute of Agricultural Research and Training, Obafemi Awolowo University, Moor Plantation, P.M.B. 5029, Ibadan, Nigeria.
[3]Federal College of Agriculture, P.M.B. 5029, Moor Plantation, Ibadan, Nigeria.

Corresponding Author -:owosibo@yahoo.com

Targeted audience: Poultry farmers, feed millers, Researchers, Animal Scientists, Veterinarian, Consumers

ABSTRACT

This study was carried out with one hundred and twenty (120) day-old marshal chicks to investigate the effect of Maxigrain® enzyme supplementation of corn bran based diets on growth performance, carcass characteristics, haematology and serum biochemistry of broilers in an eight weeks experiment. Four experimental diets were formulated, Diet A served as the Control diet containing no corn-bran. Diet B contained 20% corn-bran without maxigrain enzyme. Diets C and D contained 20% corn-bran with inclusion of 0.01% and 0.02% enzyme respectively. The birds were randomly allotted to four dietary treatments with each treatment being replicated three times in completely randomized design. Data were collected on feed intake and weight gain, while blood samples were collected from the animals through the jugular vein for haematology and serum biochemistry. At 56 days of the experiment, 6 birds were randomly selected per treatment, starved overnight, weighed and sacrificed by cervical dislocation for carcass analysis. Feed intake and cost of feed consumed per bird were significantly ($P<0.05$) influenced by the dietary treatment. Also enzyme supplementations of corn bran based diets for broilers had no significant effects ($P>0.05$) on carcass parameters except breast and neck weights. The packed cell volume, haemoglobin concentration and white blood cells were within the range of 28.00-35.33%, 9.30 – 11.57 g/dl and 14.04 – 17.50 $x10^3/mm^3$ in that order. It can be concluded that corn bran can be included in the diets of broiler chicken up to 20% inclusion level without any detrimental effect on their performance, carcass characteristics and blood parameters.

Keywords: Performance, carcass, haematology, serum, enzyme

Description of Problem

Nigeria is currently faced with short supply and high cost of conventional feed ingredients for poultry rations. Over the years, there has been much effort directed towards the exploitation and the use of non-conventional ingredients in feed production (1). Corn bran is a major by-product of milling process from corn which represents ready feedstuffs for feed formulation in animal production. It is highly fibrous and this limits its utilization because its high fibre cannot be digested by the endogenous enzymes of poultry and can have anti-nutritive effects. They cause an increase in viscosity of intestinal content and entrap large amounts of well digestible nutrients like starch and proteins. This leads to an impaired digestion and digestive problems (2).

Exogenous enzyme supplements are used widely in poultry diets in an attempt to improve nutrient utilization, the health and welfare of the birds, product quality and to reduce pollution as well as to increase the choice and content of ingredients which are acceptable for inclusion in diets (3). Enzymes have been approved for use in poultry feed because they are natural products of fermentation and therefore pose no threat to the animal or consumers (4). Their use in poultry feeds has predominantly been related to the hydrolysis of fibre or non-starch polysaccharide fraction of cereal grains. Many scientists have demonstrated performance benefits of enzymes when added to barley (5), wheat (6), (7) and more recently maize based diets (8). Maxigrain® is a concentrated blend of Phytase (2500FTU), alpha-Amylase, Acid protease, Lipase, Beta-Glucanase (200i.u), xylanase (10,000i.u), Pectinase, cellulase, mannanase, with yeast extract and minerals. This study aims to assess the performance and carcass characteristics of broilers fed corn bran based diets supplemented with enzymes (Maxigrain®)

MATERIALS AND METHODS

This study was carried out at the Poultry Unit of Teaching and Research Farm of Federal College of Animal Health and Production Technology, Ibadan. Nigeria. One hundred and twenty day-old broiler chicks were used for the study. The birds were raised on control diets for 1 week before allotment to four dietary treatments with each treatment replicated three times for eight weeks in a completely randomized design. Four experimental diets A, B, C and D were formulated as shown in Tables 1 and 2. Diet A served as the control diet containing no corn-bran. Diet B contained 20% corn-bran with no maxigrain® enzyme. Diets C and D contained 20% corn-bran with inclusion of 0.01% and 0.02% enzyme supplement, respectively. Corn-bran used was purchased from commercial feed mill in Ibadan metropolis in the South-west, Nigeria.

Performance characteristics

Known quantity of feed was supplied to the birds and the left over removed and weighed to determine the actual feed

consumed on daily basis. The daily feed consumption was added together over a period of 7 days to obtain the feed consumption per week. The body weights were taken on weekly basis. The difference between mean weights for two successive weeks was taken in order to obtain the average weight gain of birds per week.

Feed conversion ratio was calculated as a ratio of feed consumed and body weight gain

$$\text{Feed conversion ratio} = \frac{\text{Feed intake}}{\text{Weight gain}}$$

Blood sample collection and analysis

At the end of the feeding trial, 2 broilers were selected from each replicate, 4ml of blood sample was taken from the jugular vein with a sterile syringe. 2ml of blood was put into sample bottle containing Ethylene DiamineTetracetic Acid (EDTA) as an anticoagulant for haematological assay. The remaining 2ml of the blood sample was put into a sterile sample bottle without anticoagulant for serum biochemical assay. The haematological indices assessed include packed cell volume (PCV), red blood cell count (RBC), white blood cell (WBC) counts and the haemoglobin concentration (Hb) in blood samples. The PCV, RBC, WBC and Hb values were determined using the Wintrobe's micro haematocrit, improved Neubaurer haemocytometer and Cyanomethaemoglobin method, respectively (9). The mean corpuscular haemoglobin (MCH) was calculated according to (10). Serum protein, albumin, Urea and Creatinine were analyzed as outlined by (11).

Carcass Characteristics

At the end of eight week of the feeding trial, two birds from each replicate with approximate body weights equal to the mean weight of the birds in the pen were selected and weighed. The selected birds were slaughtered for carcass analysis. They were then defeatheredand eviscerated. The cut up parts like drumsticks, breast, back, thigh, wing, head and shank were weighed and expressed as percentages of the live-weight. The dressed weights were taken and the dressing percentages computed.

Statistical analysis

The data collected were subjected to statistical analysis of variance procedures of (12). The significant treatment means were separated using the Duncan's procedure of the same software.

Results

The results of the performance characteristics of broilers fed corn bran based diets with or without enzyme supplementation is as presented in Table 3, while Table 4 shows the carcass characteristics of the experimental animal. The result shows that dietary treatments had no significant effects ($p>0.05$) on the final weight, weight gain and feed conversion ratio. While feed intake and cost of feed consumed per bird were significantly ($p<0.05$) influenced by the dietary treatment. Birds on diet C (20% corn bran + 0.01% enzyme) consumed the highest (6084.80g) quantity of feed, while those on diet A (control) consumed the least (5412.50g). The lowest cost of feed

Table 1: Gross Composition (g/100gmDM) of experimental diet of broiler fed corn bran based diets with enzyme supplementation at starter phase.

Ingredients	A	B	C	D
Maize	56.00	36.00	36.00	36.00
Groundnut cake	16.70	16.70	16.70	16.70
Corn bran	-	20.00	20.00	20.00
Soy bean meal	20.00	20.00	20.00	20.00
Fish meal (72%)	2.00	2.00	2.00	2.00
Salt (NaCl)	0.30	0.30	0.29	0.29
Premix (starter)	0.25	0.25	0.25	0.25
Maxigrain	-	-	0.01	0.01
Lysine	0.50	0.50	0.50	0.50
Methionine	0.25	0.25	0.25	0.25
Limestone	1.50	1.50	1.50	1.50
Total	100.00	100.00	100.00	100.00
Metabolizable energy	2886.07	2699.03	2699.03	2699.03
Crude protein	22.57	23.16	23.16	23.16
Crude fibre	3.47	5.03	5.03	5.03

A- Maize only., B – 20% corn bran-enzyme., C- 20% corn bran + 0.01enzyme D- 20% corn bran + 0.02 enzyme

Table 2: Gross Composition (g/100gmDM) of experimental diet of broiler fed corn bran based diets with enzyme supplementation at finisher phase.

Ingredients	A	B	C	D
Maize	63.00	43.00	43.00	43.00
Corn bran	-	20.00	20.00	20.30
Soy bean meal	30.50	30.05	30.05	30.05
Fish meal (72%)	1.50	1.50	1.50	1.50
Salt (NaCl)	0.30	0.30	0.30	0.30
Premix (starter)	0.25	0.25	0.25	0.25
Maxigrain	-	-	0.01	0.02
Lysine	0.20	0.20	0.20	0.20
Methionine	0.25	0.25	0.25	0.25
Limestone	1.50	1.50	1.50	1.50
Bone meal	2.50	2.50	2.50	2.50
Total	100.00	100.00	100.00	100.00
Metabolizable energy	2943.49	2757.09	2757.09	2757.09
Crude protein	20.07	20.57	20.57	20.57
Crude fibre	3.70	5.29	5.26	5.26

A- Maize only., B – 20% corn bran-enzyme., C- 20% corn bran + 0.01enzyme D- 20% corn bran + 0.02 enzymes.

consumed per bird was recorded by birds on diet D (20% corn bran + 0.02% enzyme), while those on diet B (20% corn bran – enzyme) had the lowest value. All the carcass characteristics (Table 4) parameters measured, except breast weight and neck weight were not significantly ($p>0.05$) influenced by the dietary treatments. The breast weight was increasing across the treatment as the enzyme supplementation increased, with birds on diet D having the highest value (20.52%) while those on the control diet recording the lowest value (16.78%). Birds fed with diet B had the highest ($P<0.05$) neck weight, while those on diets A, C and D had similar neck weight.

Table 3: Performance characteristics of broilers fed corn bran based diets with or without enzyme supplementation.

Parameters	A	B	C	D	±SEM
Initial weight (g/bird)	147.50	148.61	151.39	151.11	2.12
Final weight (g/bird)	2030.83	1979.81	2187.00	2046.77	37.01
Weight gain (g/bird)	1883.34	1831.20	2035.78	1895.66	36.47
Feed intake (g/bird)	5412.50^{c}	5267.60^{b}	6084.80^{a}	5830.80^{ab}	113.47
Feed conversion ratio	2.88	2.88	2.99	3.08	0.04
Cost/kg feed (Ɛ)	96.57	92.46	92.66	92.81	3.56
Cost of feed consumed/bird (Ɛ)	523.14^{ab}	486.86^{b}	562.33^{a}	540.72^{a}	9.88
Cost/kg gain (Ɛ)	278.42	266.27	277.04	285.85	3.94

$^{a, ab, b}$ Means in the same row with different superscripts are significantly different (P<0.05)

Table 4: Carcass characteristics of broilers fed corn bran based diets with or without enzyme supplementation. (% live weight).

Parameters	A	B	C	D	±SEM
Live weight (g)	2150.00	2318.30	2275.00	2183.30	53.59
Eviscerated weight (g)	80.96	78.59	78.24	77.57	0.76
Dress weight	67.03	67.14	68.46	67.59	1.08
Breast	16.78^{b}	17.66^{ab}	19.74^{ab}	20.52^{a}	0.60
Thigh	10.69	12.06	11.86	11.10	0.29
Drumstick	10.09	9.76	10.16	9.98	0.21
Back	16.69	18.61	18.32	18.51	0.39
Neck	3.57^{ab}	4.04^{a}	3.96^{ab}	3.28^{ab}	0.12
Shank	4.55	4.79	4.67	4.04	0.15
Head	2.79	2.88	2.67	2.60	0.06
Wing	8.48	8.65	8.39	8.24	0.17

$^{a, ab, b}$ Means in the same row with different superscripts are significantly different (P<0.05)

Table 5 show the haematological indices of broilers fed corn bran based diets with or without enzyme supplementation, while Table 6 show the serum biochemistry of broilers fed the experimental diets. Packed cell volume (PCV), Hb and WBC values were significantly (p<0.05) influenced by the dietary treatments while all other parameters were not significantly (p>0.05) different. The values for PCV ranged (28.00 – 35.33%), Hb (9.30 – 11.57g/dl) and WBC (14.04 – 17.50x10^{3}/mm^{3}) respectively. It was observed that the value for PCV, Hb and WBC was reducing across the dietary treatment.

All the serum biochemical indices measured (Table 6) were not significantly (p>0.05) influenced by the dietary treatments.

DISCUSSION

The non significant final weight, weight gain and feed conversion ratio is an indication that the test ingredients were well utilized by the birds. The profit obtained from broilers depends on the carcass quality and feed conversion or feed efficiency ratio. A lower value and no significant effect recorded for the feed conversion ratio (FCR) is an indication of better performance and feed conversion into flesh, and also an

Table 5: Haematological indices of broilers fed corn bran based diets with or without enzyme supplementation.

Parameters	A	B	C	D	±SEM
Packed cell volume (%)	35.33^{a}	32.67^{a}	31.33^{ab}	28.00^{b}	0.99
Haemoglobin (g/dl)	11.57^{a}	10.87^{ab}	9.30^{b}	10.43^{ab}	0.32
Red blood cell (x 10^6/mm^3)	3.08	3.10	3.00	3.36	0.11
White blood cell (x 10^3/mm^3)	17.50^{a}	14.05^{b}	15.47^{ab}	14.43^{ab}	0.59
Mean corpuscular volume (fl)	113.19	105.67	104.32	93.22	5.65
Mean corpuscular haemoglobin concentration (g/dl)	33.17	33.23	33.20	33.27	0.02
Mean corpuscular haemoglobin (µg)	37.86	35.16	34.65	31.04	0.18

$^{a, ab, b}$ Means in the same row with different superscripts are significantly different ($P<0.05$) GIT: Gastro Intestinal Tract

Table 6: Serum biochemistry of broilers fed corn bran based diets with or without enzyme supplementation.

Parameters	A	B	C	D	±SEM
Total protein (g/dl)	4.39	4.13	4.60	4.87	0.19
Albumin (mg/dl)	1.43	1.60	1.51	1.63	0.05
Globulin (mg/dl)	2.96	2.53	3.08	3.24	0.16
Urea (mg/dl)	27.82	31.88	23.77	28.98	2.36
Creatinine (mg/dl)	0.71	0.64	0.52	0.65	0.04
Cholesterol (mg/dl)	84.75	98.54	108.69	110.87	5.48
Glucose (mg/dl)	97.88	91.73	92.17	84.78	2.34

$^{a, ab, b}$ Means in the same row with different superscripts are significantly different ($P<0.05$) GIT: Gastro Intestinal Tract

indication that all the corn bran based diets with or without enzyme supplementation were properly utilized by the broiler chicken. This agreed with the work of (13) who reported that a supplemental enzyme (axylanase) significantly improved the body weight, bodyweight gain, feed intake and feed conversion ratio in broiler chicks maintained on triticale (aviscous cereal). The increase in feed intake in the birds on the enzyme-supplemented diets corroborates the earlier report of (14) that enzyme supplementation enhanced feed intake by broilers. One of the strategies earlier reported (15, 2) to improve nutritive value of wheat bran is dietary supplementation with appropriate enzyme which elicits a positive effect on performance of broilers and even layers. As reported in previous studies (16;17) enzyme can partially hydrolyze NSP, reduce viscosity of gut contents, and result in improvement in nutrient absorption. The important role of breaking down cell wall and releasing nutrients thereby making a uniform mixture in the gut leads to increased digestibility of nutrients especially carbohydrates. Improved gain, feed efficiency intestinal viscosity, digesta dry matter and digestibility arewith enzyme supplementation (18).In the current

study, breast, thigh and total body weight were affected by the dietary treatments. Through the results achieved here, it was shown that the breast weight increase as the inclusion level of enzyme supplementation increased. The results of this study are in agreement with what was earlier reported by (19) who reported no significant effect on breast, thigh and wing components when a corn-soy-based diet was supplemented with 1000mg multi-enzyme (Avizyme 1500®) per kg of the diet. Blood is an important indices and a reflection of the effects of dietary treatments on the animals in terms of the type, quality and amounts of the feed ingested and were available for the animal to meet its physiological, biochemical and metabolic necessities (20, 21, 22). Reports by (23) and (24) indicated that the blood variables most consistently affected by dietary influences include RBC, PCV, plasma protein and glucose. Although PCV, Hb and WBC were significantly ($P<0.05$) influenced by the dietary treatment, the values obtained were within the normal range for broiler chicken reported by (25). All serum biochemical parameters measured were not influenced by the dietary treatment, this is an indication that the diets were well tolerated by the animals.

Conclusion and Applications

From the results of this experiment, it can be concluded that corn bran can be included in the diets of broiler chickens up to 20% inclusion level without any detrimental effect on their performance, carcass characteristics and blood parameters.

References

1. Nduaka U.K. (2006). Effects of enzyme supplementation on the utilization of fibrous feed ingredients in broiler diets. M.Sc. Thesis, Animal Science Department, Faculty of Agriculture, Ahmadu Bello University, Zaria
2. Almirall, M., Francesch, N., Perez – Vendrell, A.M., Brufall, J. and Esteve – Garcia, E., (1995): the difference in intestinal viscosity produced by barley and β– glucanase alter digesta enzyme activities and ileal nutrient digestibilities more in broiler chicken than in Cockerels. *Journal of Nutrition,* 125: 947-955
3. Acamovic, T. (2001). Commercial application of enzyme technology for poultry production. *World Poultry Science Journal*, 57: 226-242.
4. VukicVranjes, M. and C. Wenk, (1993). Influence of dietary enzymes complex on broiler performance in diets with and without antibiotic supplementation. In: Wenk, C. and Boessinger, M. (ed). *Enzymes in animal nutrition.* KartuaseIttingen, Thurgau, Switzerland, pp: 152-155.
5. Brenes, A., W. Guenter, R.R. Marquardt and B.A. Rotter, (1993). Effect of $-glucanasepentosanase enzyme supplementation on the

performance of chicken and laying hens fed Wheat, barley, naked oats and rye diets. *Canadian Journal of Animal Science*, 73: 941-951.

6. Classen, H.L., Scott, T.A., Irish, G.G., Huck, P., Swift, M. and Bedford, M.R. (1995). The relationship of chemical and physical measurements to the apparent metabolizable energy (AME)of wheat fed broiler chickens with or without a wheat enzyme source. In Proceedings of Second European Symposium on Feed Enzymes, pp: 65-69.
7. Hughes, R.J. and Zviedrans, P., (1999). Influence of dietary inclusion rate of wheat on AME, digesta viscosity and enzyme response. Proc. Australian Poultry Science Symposium. 11, 101-104.
8. Wyatt, C.L., Bedford, M.R. and Waldron, L.A., (1999). Role of enzymes in reducing variability in nutritive value of maize using the ileal digestibility method. Proc. Australian .Poulry Science Symposium. 11,108-111.
9. Coles, E.H. (1986). Veterinary Clinical Pathology, 4th Ed. W.B. Saunders, Philadelphia, USA pp.
10. Bush, B.M. (1991). Interpretation of Laboratory Results for Small Animal Clinicians. Blackwell Scientific Publications. London, UK, pp: 32 – 67.
11. Ochei, J and Kolhatkar, A. (2000). *Medical Laboratory Science Theory and Practice*. Tata McGraw-Hill Company Limited, New Delhi.
12. SAS (2008). SAS/STAT Users Guide: Version 9.2 for Windows. SAS Institute Inc. Cary, N.C., USA.
13. Pourreza, J., Samie, A.H. and Rowghani, E. (2007). Effect of supplemental enzyme on nutrient digestibility and performance of broiler chicks fed on diets containing triticale. *International Journal of Poultry Science*, 6(2): 115-117
14. Tuleun, C.D., P.C. Njoku and I.D.I. Yaakugh. (1998). The performance of pullet chicks fed Roxazyme in diets containing graded levels rice offals. In Proc of the 3rd Annual Conference of the Animal Science Association of Nigeria, pp:74-76
15. Bedford, M.R. and Classen, H.L.(1992). Reduction of intestinal viscosity through manipulation of dietary rye and pentosans concentration is affected through change in carbohydrate composition of intestinal aqeous phase and result in improved growth rate food conversion efficiency of broiler chick. *Journal of Nutrition,* 122:560-566
16. Yu, B., Hsu, J.C. and Chiou, P.W. S., (1997). Effect of β– glucanase supplementation of barley diets in growth performance of broiler *Animal Feed Science and Technology*.70: 253 – 361.
17. Scheideler, S. E., Beck, M.M., Abudabos, A. and Wyatt, C.

(2005).multiple enzyme (Avizyme) supplementation of corn-soya meal based layer diets. *Applied Poultry Research.* 14: 77-80

18. Baker, N.J., Parson, A.S. and Mortz, (2000).Effect of various phytase concentrations in diet with low phytate corn on broiler chick performance and nutrient use. *International Journal of Poultry Science,* 6 (20): 77-74
19. Café M.B, Borges CA, Fritts C.A, Waldroup PW. (2002). Avizyme improves performance of broilers fed corn-soybean meal-based diets. *Journal of Applied Poultry Research*. 11:29–33.
20. Ewuola., E.O, Folayan., O.A., Gbore, F.A., Adebunmi, A.J., Akanji, R.A., Ogunlade, J.T. and Adenaye, J.A. (2004). Physiological response of growing West African goats fed groundnut shell- based diets as the concentrate supplements. *BOWEN J. Agric.*1(1):61-69.
21. Olorode, B.R., Onifade, A.A., Okpara, A.O. and Babatunde, G.M. (1996). Growth, Nutrient Retention, Haematology and Serum chemistry of Broiler Chicken fed Shea butter cake or Palm Kernel Cake in the Humid Tropics. *Journal of Applied Animal Research,* 10:173-180.
22. Odetola, O.M., Ewuola, E.O and Adu, A.O. (2012).Haematology, Serum Biochemistry and Organ Histopathology of Rabbits Fed Graded Levels of Whole Kenaf (*Hibiscus cannabinus*) Seed Meal. *International J. of Agric. Research* 7(2): 86-92.
23. Aletor, V.A. (1989). Effect of varying levels of fishmeal substituition with soya bean meal on certain metabolites. *Nigerian J. Technol. Research.* 1: 111-114.
24. Aletor, V.A. and Egberongbe, O. (1992).Feeding differently processed soybean. Part 2: An Assessment of Haematological Responses in the Chicken diet. *Nahrung,* 36(4): 364-369.
25. Mitruka, B.M. and Rawnsley, H.M. (1977). *Clinical Biochemical and Haematological references' values in normal experimental animal* Masson Publishing U.S.A Inc. New York.