Trop. Anim. Prod. Invest. 20 (1): 9 – 14 (2017)
ISSN: 1115-2540
http://animalsci.agric.ui.edu.ng/TAPI/index.php/tapijournal/index

ORIGINAL RESEARCH ARTICLE

Growth Performance and Haematological Indices of Arbor Acre Broilers fed with High Wheat Bran Based Diets Supplemented with Enzymes

Alabi, O.O*[1], Ogundele, O.O.[2] Akurunwah, C. O[1], Akintunde A. M[1] and Ibeh, G. U[1]
Department of Animal Science, Landmark University, Omu-Aran, Kwara State, Nigeria[1]
Department of Animal Production, University of Ilorin, Ilorin, Kwara State, Nigeria[2]
*alabi.olayinka@lmu.edu.ng

Abstract
This experiment was carried out to investigate the growth and haematological indices of arbor acre broilers fed with high wheat bran diets supplemented with natuzme and maxigrain enzymes. The enzymes were added at manufacturer's recommendation of 35g to 100kg of diet; the inclusion level of wheat bran was 25%. The experimental design was a completely randomized design with four (4) experimental diets; control diet without enzyme supplementation (T1), diet supplemented with natuzyme (T2), diet supplemented with maxigrain (T3) and diet supplemented with combination of natuzyme 17.5g to 50kg and maxigrain 17.5g to 50kg (T4). In a feeding trial that lasted 56 days, one hundred and forty-four (144) day old broilers chicks of mixed sexes of commercial strain (Arbor-acre) chicks were randomly assigned to the four treatments of three replicates each with twelve chicks per replicate. The birds were housed in an electrically heated battery cage. Experimental diet and water were supplied *ad-libitum* to the birds from the first day to day 56 with the birds subjected to the recommended routine vaccination programme. At the end of the feeding trial, 2 birds per replicate were randomly selected for haematological analysis. 3ml blood samples were collected from the wing web with the birds euthanatized by neck decapitation and eviscerated and weights (live and dressed) were determined. The results showed that diet without commercial enzyme supplementation showed significant decrease ($p<0.05$) in weight gain and feed conversion ratio. Results obtained showed that birds fed diet supplemented with combination of natuzyme and maxigrain enzymes had better growth performance than those fed diet either supplemented with natuzyme or maxigrain. The result of haematological parameters; packed Cell Volume (PCV), haemoglobin concentration (Hb) and white blood cells differentials (neutrophils, lymphocytes, basophils and eosinophils) showed no significant differences ($P > 0.05$) in the treatment means of all parameters evaluated. It is concluded that usage of combination of natuzyme and maxigrain gave a better weight gain needed by farmer for poultry production.

Keywords: Broiler chickens, Enzymes, Fibre, Wheat.

Introduction
The Cost of production of poultry is associated with the cost of feed. The cost of feed is also related to the cost of ingredients. Maize is a major ingredient in the poultry diets. Its availability and price are influenced by competition between man, industry and livestock. Hence it makes economic sense to find cheap alternatives for maize in poultry diets. Most of the alternative feed ingredients for maize contain Non-Starch Polysaccharide (NSP) (Dalibord, 2006). However, the broilers digestive enzyme profiles are not designed to digest NSP thereby limiting the broilers ability to utilize high fibre feedstuffs. This intolerable high fibre content causes digestive inefficiency of the gastro-intestinal tract thereby reducing the effect of digestive enzymes and absorption of nutrients (Jozefiak *et al* 2004). Efforts to extract more nutrients from feedstuffs (both conventional and non-conventional) have been a focus for research for decades (Peter and Hoffman 2002). In recent times more effort has been directed towards harnessing and utilizing by-products and wastes which are not directly utilizable by man, and take advantage of the convertible mechanism of animal organ to convert what is seen as a waste into wholesome animal product for human consumption (Atteh 2002).

Fibre utilization by monogastric livestock has recently gained interest for various reasons (Grieshop *et al* 2001). Dietary fibre components undergo a limited conversion to substance available for absorption in poultry and could be degraded only by exogenous enzymes (Selle and Ravindran 2007). Wheat bran, a by-product of the milling of wheat (*Triticum aestivum* L.) into flour, is one of the major agro-industrial by-products used in animal feeding Wheat bran contains up to 15.2% crude protein(CP), but can be up to 12% crude fiber (CF) which limits its use to less than 5% as a feed ingredient in broiler rations (NRC 1994).

Fiber is the main constraint for the utilization of wheat bran in animal nutrition. Monitoring the response and progress of livestock fed with non-conventional feeding regimes, can be done through the routine collection and processing of blood samples which will allows for the evaluation of hematological responses to diseases (Howlett and Jaime, 2008) and a readily available and fast means of assessing clinical and nutritional health status of the animal on feed trial can be the use of blood analysis. Generally, both the biochemical and hematological blood components are influenced by the quantity and quality of feed and also the level of anti-nutritional elements or factors present in the feed (Akinmutimi 2004). They can also be used to monitor protein quality of feeds. Haematological components of blood are also valuable in monitoring feed toxicity especially with feed constituents that affect the formation of blood (Oyawoye and Ogunkunle 1998). Abu and Onifade (1996) reported that low level haemoglobin (Hb) could imply that dietary proteins were not of high quality.

Diets containing poor protein would usually result in poor transportation of oxygen from the respiratory organs to the peripheral tissues (Ross *et al.,* 1978). Reduction in the concentration of PCV in the blood usually suggests the presence of toxic factor (e.g. haemagglutinin) which has adverse effect on blood formation. Hence the need to investigate the haematological indices and to develop practical intervention for enhancing the productivity of Arbor-acre broiler chicks fed high wheat bran-based diet supplemented with one or combination of natuzyme and maxigrain enzymes.

Table 1: Gross Composition (g/100g) of Experimental Diets

Ingredients (kg)	T1	T2	T3	T4
Maize	35	35	35	35
Wheat bran	25	25	25	25
SMB	30	30	30	30
Fish Meal	5	5	5	5
Bone meal	2.25	2.25	2.25	2.25
Limestone	1	1	1	1
Broiler premix	0.5	0.5	0.5	0.5
Salt	0.25	0.25	0.25	0.25
Methionine	0.5	0.5	0.5	0.5
Lysine	0.5	0.5	0.5	0.5
Natuzyme	-	*	-	-
Maxigrain	-	-	*	-
Natuzyme+Maxi grain	-	-	-	*
Total	100	100	100	100
Analyzed composition				
Crude protein (%)	21.25	22.25	22.55	22.35
Crude fibre (%)	6.74	6.75	6.74	6.77
Ether extract (%)	3.52	3.55	3.55	3.50
ME (Kcal/kg)	2803	2801	2809	2811
Calcium (%)	1.41	1.40	1.47	1.44
Phosphorus (%)	0.77	0.79	0.78	0.79
Lysine (%)	0.84	0.81	0.86	0.84
Methionine (%)	0.71	0.70	0.73	0.71

Materials and Methods

Site of the experiment: The study was carried out in the poultry unit of the Teaching and Research Farm of Landmark University, Omu-Aran, Kwara State located within the guinea savannah zone of Nigeria.

Experimental diets: The birds were assigned to four (4) experimental diets as shown in Table 1; control diet without enzyme supplementation (T1), diet supplemented with natuzyme (T2), diet supplemented with maxigrain (T3) and diet supplemented with combination of natuzyme and maxigrain (T4). The enzymes were added at manufacturer's recommendation of 35g to 100kg for T2 and T3 but T4 was compounded using 17g of natuzyme to 50kg and 17g maxigrain to 50kg.

Experimental birds and management:

One hundred and forty-four (144) broilers chicks of mixed sexes of commercial strain (Arbor acre) were allocated randomly to four diets in a completely randomized design and each treatment was replicated three (3) times with 12 chicks per replicate. The birds were housed in an

electrically heated battery cage for eight weeks. Experimental diets and water were supplied *ad-libitum* to the birds from day 1 to 56 day and were subjected to routine vaccination programme recommended for broiler. The birds were weighed at the beginning of the trial and there after every week. Mortality was recorded daily. At week eight 2 birds per replicate were randomly selected. Individually weighed birds were slaughtered by slitting the jugular vein. Live weight and dressed weight were taken and recorded. All data generated were subjected to the analysis of variance (ANOVA) as described by Steel and Torrie, 1990. Where significant differences exist between treatments means, Duncan Multiple Range Test (Duncan 1955) was used to separate the means.

Procedures for collecting blood samples for hematological indices:

Two birds per replicate were randomly selected at the end of the feeding trial and 3ml blood samples were collected from the wing web by bleeding the wing vein with a needle and syringe to withdraw blood from the experimental bird. The blood collected in syringe was put inside clean Lavender top bottles containing ethylene diamine tetra acetic (EDTA) to prevent the collected blood sample from coagulating. One needle and syringe per bird was used for bleeding and collecting of blood. The blood samples were put inside twelve different Lavender top bottles (one bottle per blood sample per marked experimental bird). Packed cell volume was determined by the method of Wintrobe (1933), the red and white blood cells were determined as reported by Jain (1986) while haemoglobin was estimated as reported by Swensen (1951) and Coles (1986).

Results and Discussion

Use of high fibrous feed ingredients has been discouraged in monogastric feed formulation especially poultry. This is due to the poor utilization of nutrients culminating into poor feed conversion ratio, poor performance and decreased body weight. 25% inclusion of wheat bran is highly fibrous and high inclusion in diet formulation is not encouraged (Adebiyi *et al* 2010) Fibrous feed materials cannot be broken down by poultry own digestive enzymes, and so some potential nutrients are unavailable to the animal

(Makinde *et al.,* 2014). Monogastrics cannot handle cellulose, hemicellulose, and beta-glucanose. Feeding of high fibrous diets to broilers will not be adequately utilized, more so, they have anti-nutritive activity which is manifested by wet droppings and poor utilization of nutrient in them. Enzymes have been used in monogastric diets to increase nutrient digestibility and decrease nutrient waste in excreta (Atteh, 2000). Fiber is the main constraint for the utilization of wheat bran, the energy values of wheat bran are always lower than those of the whole grain hence the increase feed intake in T1, T3 and T4 as shown in Table 2 to meet up the energy requirement of the birds, however the intake of birds fed T2 reduced compared to remaining treatments. Another factor that influenced the use of wheat bran is the phytase activity; This is because wheat grain contains relatively high concentrations of non-starch polysaccharides (NSPS), which are indigestible in broilers, other factors that affect wheat bran utilization in poultry is the viscous nature, the physiological and morphological pattern of the digestive tract and the interaction of the intestinal micro flora (Gao *et al.,* 2007).

Table 2: Performance characteristics of broiler chickens fed experimental diets

Parameter	T1	T2	T3	T4	SEM
Initial bird weight /g	54	54	54	54	0.01
Weight gain/bird/ kg	2.09^{c}	2.15^{b}	2.09^{c}	2.31^{a}	0.03
Feed intake/bird/kg	5.70^{b}	5.59^{c}	5.84^{a}	5.87^{a}	0.06
Feed Conversion Ratio	2.73^{a}	2.60^{c}	2.65^{b}	2.55^{d}	0.03
Live weight/ bird/kg	2.49^{c}	2.53^{b}	2.50^{b}	2.73^{a}	0.03
Dressed weight/bird/kg	1.62^{c}	1.66^{b}	1.64^{b}	1.70^{a}	0.02

abc: Means in the same row with different superscripts indicate significant differences ($P<0.05$)

Much research work shows that supplementation of appropriate exogenous enzyme in wheat bran diets remove anti-nutritional components in feeds, intestinal viscosity thereby improving digestible nutrients in broilers (Wang *et al.,* 2005; Basmacioglu *et al.,* 2010). Extensive research conducted in poultry throughout the world has clearly demonstrated that adding exogenous enzymes to diets rich wheat as observed in the weight gain of birds fed diet supplemented with enzymes (Garcia *et al.,* 2000). The highest weight gain was obtained from birds fed with diet supplemented with the combination of natuzyme and maxigrain which was significantly different from those birds fed diet without enzyme supplementation ($P<0.05$), supplementation of the diet (T4) with natuzyme and maxigrain had better effect because of synergistic effects of different enzymes on the diet. There were significant differences ($P<0.05$) observed in the feed conversion ratio among the treatments. The conversion ratio for diet supplemented with combination of maxigrain and natuzyme was the best. The performance of broiler chicken fed diet with combination of natuzyme and maxigrain enzyme supplementation showed an increase in weight gain than birds fed diet with either natuzyme or maxigrain enzyme supplementation. The live weight and dressed weight birds fed control diets are lower than those fed diet supplemented with enzyme. This is in agreement with the report of Anuradha and Barun (2015). The authors reported that enzyme supplementation to fibrous diet improve the growth rate and thereby increasing the dressing percentage. The results for hematological analysis carried out at the 8th week are as shown in Table 3. There were no significant differences ($P<0.05$) among the various parameters. Birds fed diet supplemented with combination of natuzyme and maxigrain enzymes had the highest values for PVC, RBC, WBC and Hb. Haematological values showed that the birds were within the normal range for healthy birds (Afolabi *et al*, 2010).

Table 3: Effect of experimental diets on blood parameters of broilers at 52 days.

Diet	PVC (%)	RBC ($\times10^{12}$/L)	WBC ($\times10^{9}$/ L)	Hb (g/dl)	Lymphocyte (%)	Neutrophil (%)	Basophil (%)	Eosinophil (%)
T1	27.02	4.30	10.92	7.81.	64.40	34.85	0.00	0.70
T2	26.49	4.20	10.71	7.79	64.94	34.56	0.00	0.50
T3	26.50	4.23	10.75	7.72	64.95	34.55	0.00	0.50
T4	27.23	4.79	10.95	8.06	65.77	33.43	0.00	0.80
SEM	3.27	0.67	0.46	0.42	1.81	2.16	0.00	0.55

Conclusion

The performance of broiler chicken fed diet with combination of natuzyme and maxigrain enzymes supplementation at the recommended inclusion level of 35g/100kg of feed showed an increase in weight gain and better feed conversion ratio than birds fed diet supplemented with one of natuzyme or maxigrain enzyme and there was no adverse effect of enzyme supplementation of any of the diet on the blood parameters evaluated.

Conflict of Interest Statement

This research was funded by the researchers themselves and so there cannot be any conflict of interest from any other source since it was not funded by any agency, organization or individuals aside the researchers.

References

Abu, O.A. and Onifade, A.A. 1996. Effects of cassava wastes substitution for maize in weaner rabbit diets. Bull. Anim. Hlth. Prod. Afr., 44: 167-172

Adebiyi, A.O., A.D. Ologhobo, O.A. Adu and T.O. Olasehinde, 2010. Evaluation of the Nutritional Potentials of Physically Treated Cowpea Seeds Hulls in Poultry Feed. *Emirates Journal. Food Agriculture.* 22:232-239.

Afolabi, K.D., Akinsoyinu, A.O., Olajide, R.R. and Akinleye, A.B. 2010. Haematological parameters of Nigerian local grower chickens fed varying levels of palm kernel cake. Proc. 35th Conf. Soc. For Anim. Prod.,

14-17 March, 2010. Univ. of Ibadan. Pp 347-349.

Akinmutimi, A. H 2014. Effect of cooking periods on the nutrient composition of *Mucuna utilis* seeds. Nigeria Poultry Science 3: 45 - 51

Anuradha A and Barun R., 2015 Effect of Supplementation of Fiber Degrading Enszyme on Performance of Broiler Chicken fed, Diets Containing De –Oiled Rice Bran *Asian Journal of Animal and Veterinary Advances ,*10:179-184.

Atteh, J.O. 2000. Use of enzyme to improve nutrient value of wheat. A paper presented on 2-day seminar for flour milling and baking industry. Sheraton Hotel Lagos, May 2-3, 2000.

Atteh, J. O. 2002 Principles and practices of livestock feed and manufacturing.1st ed. Ilorin: Adlek Printer; 2002

Basmacioglu, H., BaysalMisirlioglu Z, Polat, M., Yilmaz, H. and Turan, N., 2010.Effects of Oregano Essential Oil with or without Feed Enzyme on Growth Performance, Digestive Enzyme, Nutrient Digestibility, Lipid Metabolism, and Immune Response of Broilers fed on Wheat- Soya Bean Meal Diet.*Br Poultry Science*. 51; 67- 70

Coles, H. 1986 Veterinary Clinic Pathology, 4th ed. W.B. Saunder Co. Philadelphia

Dalibord, J.F. 2006 Enzyme update on targeting the Veg. Cell wall. Feed International. Watt publication. Oct. 2006.

Duncan, D.E. Multiple Range and Multiple F-tests Biometrics.1955; (11): 1-42

Gao, F., Y. Jiang, G.H. Zhou and Z.K. Han, 2007.Effect of natuzyme plus in diets containing wheat and canola meal on broiler performance. *Journal of animal production Vol 13, number 2*; Pp. 1 to 10.

Gracia, N. M., Pesti, G.M. and Bakalli, R.I. 2000. Influence of dietary protein level on the broiler chicken's response to methionine and betaine supplements. *Poult Sci.* 79: 1478 - 84

Grieshop,C, Reese,D and Fahey, G. 2001. Non-starch polysaccharides and oligosaccharides in swine nutrition. Pg.107 in swine nutrition A.j. Lewis and L.L Southern Eds. CRC Press, Boca Raton FL.

Jain, N.C. 1986. Schalm's Veterinary Haematology. 4th ed. Lea and Febiger. Philadelphia. USA.

Jozefiak, D.,Rutkowski, A. and Martin, S. 2004 The effects of dietary fibre fraction from different cereals and microbial enzyme supplementation on performance, feed viscosity and short chain fatty acid concentration in caeca of broiler chickens. *Anim. Feed Sci.* 2004 ;(13):487-496.

Makinde ,O.J., Enyigwe, P.C., Babajide, S.E., Atsumbe, J.A., Ibe, E.A. and Samuel, I.O 2014. Growth Performance and Carcass Characteristics of Finisher Broilers fed Rice Offal Diets Supplemented with Exogenous Enzyme. *Greener Journal Agricultural Sciences4* (4):144-149

Oyawoye, E.O. and Ogunkunle, M. 1998. Physiological and Biochemical effects of Raw Jack Beans on Broiler. Proc. Nig. Soc. Anim. Prod., 23: 141-142.

NRC 1994. National Research Council. Nutrient Requirements of Poultry 9thRev. Edn.National Academy Press, Washington, D. C.

Peter, R and Hoffman, D. 2002 Effect of enzyme in poultry feed. Watt Publication. October ed.2002

Rosss, J. G., Halliday, W.G. and Jones, R.M. 1978. Haematological and blood chemistry comparison values for clinical pathology. *Poultry Veterinary record* 102: 29-39

Selle, J and Ravindran. V 2007. Microbial phytase enzyme in poultry nutrition. *A Review Anim. Feed Sci. Techno* 2007 ;(35): 1-41.

Steel, R.G. and Torrie, J.H. 1990 Principle and procedure of a statistics biometrical approach (3rd edition). McGraw-Hill, New York

Swensen, M.T. 1951. Effects of vitamin B12 and liver meal on the hematology of chicks fed on all protein ration. *Anim. J. Vet. Res.,* 12: 147-151.

Wang, Z.R., Qiao, S.Y. Lu W.Q. and Li, D.F. 2005.Effects Of Enzyme Supplementation on Performance, Nutrient Digestibility, Gastrointestinal Morphology and Volatile Fatty Acid Profiles in the Hindgut of Broilers fed Wheat-Based Diets. *Poultry Science*, 84: 875-881.

Wintrobe, M.M. 1933. Microscopic examination of blood. *Am. J. Med. Sci.*, 185: 58-59