PERFORMANCE OF BROILER CHICKEN FED DIETS CONTAINING PAWPAW LEAF MEAL AND EXOGENOUS-ENZYME

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Abstract

This study evaluated the effects of Pawpaw leaf meal (PLM) inclusion and exogenous multi-enzyme supplementation on broilers performance. A 2x2 factorial arrangement in a completely randomized design was used in this experiment. Four experimental diets were formulated and designated as diet 1 (0%-E), diet 2 (0%+E), diet 3 (5%-E) and diet 4 (5%+E). Diets 1 and 3 were not enzyme supplemented but had PLM inclusion at 0 and 5% level respectively, while diets 2 and 4 were enzyme supplemented at the rate of 0.5g/kg but had PLM inclusion at 0 and 5% level respectively. One hundred and twenty (120) arbor acre two weeks-old broiler chicken were selected from a larger flock that had been raised on commercial diet. These birds were balanced for weight and thereafter distributed into 12 pens of 10 birds each. These pens were allotted to four dietary treatment groups randomly such that each experimental diet was fed to 3 replicate. The total weight gain (TWG) and feed conversion ratio (FCR) were significant ($P<0.01$) for enzyme supplementation, while PLM inclusion was significant ($P<0.05$) for TWG. The PLM and exogenous-enzyme supplementation caused 13.65% and 18.31% increase respectively in the total weight gain of the broiler chickens. Based on data obtained from this study, PLM at 5% inclusion and exogenous enzyme supplementation in the diet of broiler chicken improves the performance of the birds.

Key words: broiler chicken, enzyme supplementation, pawpaw leaf meal, performance

Introduction

Poultry production had been identified as one of the quickest means of achieving sustainable production of animal protein to meet the demand of the population of developing countries of world (Esonu *et al.*, 2004), including Nigeria where daily animal protein intake per caput fall far below 63 g per day per caput as recommended by FAO (1992). In an attempt to improve the potentials of poultry during the last decades, considerable amount of antibiotic growth promoters were used, both as growth promoting and therapeutic agents (Falcao-e-Cunha *et al.*, 2007). However, due to eventual antibiotic residues in meat and other animal products and microbial resistance in animals (Wegener, 2006), there have been controversies surrounding the use of antibiotics as growth promoters (AGPs) for food animals (Akanmu and Adeyemo, 2012). Therefore the use of alternatives to antibiotic growth promoters such as enzyme (Chot, 2006), phytogenic feed additives (Akanmu and Adeyemo, 2012) are now being considered to improve performance and boost immune response in poultry. Several previous works had showed that phytogenic feed additives could be suitable alternative to the popular AGPs. According to Akanmu and Adeyemo (2012), combination of neem and pawpaw at 1% boosted the performance, reduced pathogenic bacteria activity and reduce mortality due to infection in commercial broiler. Pawpaw tree (*Carica papaya*) belongs to the family of Caricaceae. It is an herbaceous succulent, large perenial plant with rapid growth rate (Bruce and Peter, 2008) that produces latex which contains four identified proteolytic enzymes such as papain, chymopapain A and B, and papaya peptidase A (Yadava *et al.*, 1990). Papain aid in breaking down protein and cleanses the digestive tract (Poulter and Caygill, 1985). The pawpaw leaf also contain many biochemically active compounds, some minerals and antioxidants nutrients (carotene, vitamin B, vitamin C and panthotenic acids) (Bolus *et al.*, 2009). Previous studies have shown that papaya posses antibacterial, antifungal and antiviral properties among others (Lim, 2012, Maisarah *et al.*, 2014). Various researches conducted in poultry throughout the world has clearly demonstrated that adding exogenous enzymes to diets improves bird performance (García *et al.*, 2008). The mode of action of enzymes had been related to modifications of the intestinal environment, including changes in the viscosity of the digesta (Lázaro *et al.*, 2003) which in turn may allow a better contact between nutrients, endogenous enzymes and the absorptive mucosa, and therefore a better use of the diet. The addition of cell-wall degrading enzymes (e.g. xylanases, β-glucanases) may release nutrients and facilitate the digestion of grains (Classen, 1996). Furthermore, enzyme supplementation increases the rate of passage in poultry, which may improve feed intake (Lázaro *etal.*, 2003), reduce the growth of *Clostridium* species and other anaerobes in the gut and improves the quality of litter and cleanliness of the eggs (Bedford, 2000). In view of this, pawpaw leaf and enzyme supplementation are possible means of improving the performance of poultry. Therefore, the objective of this study is to determine the effect of pawpaw leaf and exogenous enzyme supplementation on and their interaction on the performance of broiler chicken.

Materials and Methods

The experiment was carried out at the Teaching and Research Farm of the Agricultural Technology Department, The Federal Polytechnic, Ado Ekiti, Nigeria. The study area is situated at about 437 mm above sea level with latitudes of7°37′N and 7°12′N and longitudes 5°11′E and 5°31′E; and mean annual temperature of 26.2°C. The mean annual rainfall is 1247 mm.

Fresh pawpawleaves were harvested from Teaching and Research Farm of the Agricultural Technology Department, The Federal Polytechnic, Ado Ekiti, Nigeria, chopped into smaller pieces, spread lightly to air-dry under a shed for 14 days, and sun-dried for 2 hour just before being hammer milled. The leaf meal was analysed for proximate composition (AOAC 1995), phytate (Wheeler and Ferrel 1971), oxalate (Day and Underwood, 1986) and tannin (Makkar and Goodchild, 1986). The caloric value was obtained by multiplying the protein, carbohydrate and crude fat by Atwater factors of 17, 17 and 37 respectively (Kilgour, 1987). The composition of the exogenous multi-enzyme (En-BRO) produced by Aniruddha Enterprises Pvt. Ltd. is cellulase, amylase, arabinose, pectinase, phytase, protease, lipase and xylanase. Four experimental diets were formulated and designated as diet 1 (0%-E), diet 2 (0%+E), diet 3 (5%-E) and diet 4 (5%+E). Diets 1 and 3 were not enzyme supplemented but had PLM inclusion at 0 and 5% level respectively, while diets 2 and 4 were enzyme supplemented at the rate of 0.5g/kg but had PLM inclusion at 0 and 5% level respectively. One hundred and twenty (120) arbor acre two weeks-old broiler chicken were selected from a larger flock that had been raised on commercial diet. These birds were balanced for weight and thereafter distributed into 12 pens of 10 birds each. These pens were allotted to four dietary treatment groups randomly such that each experimental diet was fed to 3 replicates. All the birds were fed *ad libitum* during the experimental period. All other standard management and health practices were provided for the birds throughout the 6 weeks of the experiment. All data collected during the experiment were subjected to analysis of variance from General Linear Model procedures using SPSS version 20 (SPSS, 2011) while means were separated using Duncan's multiple range test from the same software package.

Results and Discussion

The results of chemical analysis showed that Pawpaw leaf meal (PLM) has crude protein (261.35 g/kg), ash (164.35 g/kg), crude fibre (160.45 g/kg), ether extract (53.95 g/kg) and caloric value of 2506.68 kcal/kg. The phytate level of PLM was 20.18mg/g, while 6.11 and 0.01 mg/g was recorded for oxalate and tannin respectively. The CP content of PLM was similar to those reported by Onyimonyi and Onu (2009), but higher than 173g/kg and 243.8 g/kg reported for *Microdesmis puberula* leaf (Esonu *et al.*, 2004) and 243.8 g/kg for gliricidia leaf meal (Ogungbesan *et al.*, 2013) respectively. The proximate composition of PLM showed that it could be an important source of plant protein in livestock feed. The percentage composition of the experimental diets at the finisher phase is presented in Table 1. The protein, crude fibre and energy are within the range recommended for broiler chicken. Table 2 shows that the total weight gain (TWG) and feed conversion ratio (FCR) were significant ($P<0.05$) for enzyme supplementation, while Pawpaw leaf meal (PLM) inclusion was significant ($P<0.05$) for TWG. The PLM and exogenous-enzyme supplementation caused 13.65% and 18.31% increase respectively in the TWG of the broiler chickens. However, the performance characteristics were not affected by the interaction of enzyme supplementation and PLM inclusion levels. The improvement in the weight gain of the broiler chicken as a result of enzyme supplementation agreed with earlier report of Bedford and Morgan (1996) and Garcia *et al.*, (2008). The positive influence of enzyme supplementation on performance of poultry has been linked to modification of intestinal environment, which allows a better contact between nutrients, endogenous enzymes and absorptive mucosa and better use of diets (Lazaro *et al.*, 2003). In the same vein, the improvement in total weight gain observed in this study as a result of PLM inclusion is in tandem with report of Akanmu and Adeyemo (2012) and Ebenebe *et al.*, (2011). This observed improvement in performance of broilers as a result of PLM inclusion could be that papain (protease) in PLM aids protein digestion and enhances the release of free amino acids necessary for growth (Onyimonyi and Onu, 2009).

Conclusion

Based on data obtained from this study, PLM at 5% inclusion and exogenous enzyme supplementation in the diet of broiler chicken improves the performance of the birds.

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Table 1: Composition of broiler finisher diet

	Level of Pawpaw leaf meal (%) with or without enzyme			
Ingredients (%)	Diet 1(0%-E)	Diet 2(0%+E)	Diet 3(5%-E)	Diet 4(5%+E)
Maize	61.00	61.00	60.00	60.00
Pawpaw leaf meal	0.00	0.00	5.00	5.00
Palm kernel cake	6.00	6.00	5.20	5.20
Ground nut cake	11.00	11.00	9.40	9.40
Soybean meal (42%CP)	11.50	11.50	9.90	9.90
Fish meal (72%CP)	6.00	6.00	6.00	6.00
Oyster shell	0.50	0.50	0.50	0.50
Bone meal	3.00	3.00	3.00	3.00
Premix	0.25	0.25	0.25	0.25
Methionine	0.30	0.30	0.30	0.30
Lysine	0.15	0.15	0.15	0.15
Salt	0.30	0.30	0.30	0.30
Total	**100.00**	**100.00**	**100.00**	**100.00**
Calculated analysis				
Crude protein	20.88	20.88	20.79	20.79
Crude fibre	3.29	3.29	3.34	3.34
ME (Kcal/kg)	2997.74	2997.74	2976.95	2976.95

Table 2: Effect of Pawpaw leaf meal and exogenous enzyme supplementation on performance of broiler chicken

	Enzyme (g/kg)			P	PLM (%)			P	Enzyme x PLM	
Parameters	0	0.5	SEM	value	0	5	SEM	value	SEM	P value
IW	357.22	365.61	6.31	0.37	365.50	357.33	6.31	0.38	8.92	0.87
FLW	2081.38	2476.28	72.52	0.01	2142.50	2415.16	72.52	0.02	102.56	0.82
TWG	1724.16	2110.66	72.31	0.01	1777.00	2057.83	72.31	0.02	102.26	0.83
TFI	7286.06	7746.07	191.33	0.12	7291.70	7740.44	191.33	0.13	270.58	0.14
WFI	1214.34	1291.01	31.88	0.12	1215.28	1290.07	31.88	0.13	45.09	0.14
FCR	4.24	3.71	0.17	0.05	4.17	3.79	0.17	0.16	0.252	0.62

Means with different superscripts in the same row are significantly different ($p<0.05$).
IW: Initial live weight (g/bird); FLW: Final live weight (g/bird); TWG: Total weight gain (g/bird);
TFI: Total feed intake (g/bird); WFI: Weekly feed intake (g/bird/week); FCR: Feed conversion ratio.