ISSN 1682-8356
ansinet.org/ijps

INTERNATIONAL JOURNAL OF

POULTRY SCIENCE

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International Journal of Poultry Science 8 (10): 995-998, 2009
ISSN 1682-8356

An Assessment of Pawpaw Leaf Meal as Protein Ingredient for Finishing Broiler

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Abstract: A feeding trial was conducted to evaluate the effect of dietary inclusion of Pawpaw Leaf Meal (PLM) on the performance of finishing broilers. Sixty 5 weeks old broilers were used for the study that lasted for 28 days. The sixty birds were assigned to four dietary treatments with fifteen birds per treatment in a Completely Randomized Design. Each treatment was replicated thrice. Four isonitrogenous and isocaloric broiler finisher diets containing 21% CP and 2800kcalME/kg were formulated. PLM was incorporated at levels of 0.5, 1.5 and 2.0% in treatments 2, 3 and 4 respectively. Treatment 1 had no PLM and was used as the control diet. Results should that the effect of treatments on final body weight, weight gain, daily weight gain, feed conversion ratio and feed cost/kg gain were significant ($P<0.05$). Birds on treatment 4 had a final body weight of 2972.5 g which differed significantly ($P<0.05$) from the 2612.5, 2785.0 and 2875.0 g observed for birds on T_1, T_2, and T_3 respectively. The same birds on treatment 4 gained significantly ($P< 0.05$) more weight of 2044.0 g during the study period. A feed cost/kg gain of N138.42 was also recorded for the birds on T_4 as against N167.28, N148.15 and N141.05 observed for birds on T_1, T_2 and T_3 respectively. Percentage of edible cuts as represented by dressing percentage was also significantly ($P<0.05$) higher in the birds on T_4. The meat of birds on T_4 also had a significantly ($P<0.05$) general acceptability. It is concluded that a 2% inclusion of PLM in the diet of finishing broilers could improve performance, carcass and organoleptic indices.

Key words: Pawpaw, assessment, ingredient, broilers

INTRODUCTION

The high cost of poultry feeds in Nigeria precipitated by the ever increasing cost of feed ingredients, especially protein sources has resulted in declining productivity and profitability of intensive poultry production system. This scenario has caused the prices of poultry products (egg and meat) to rise far beyond the purchasing ability of an average Nigerian. Given the central importance of broiler production in bridging the animal protein gap in Nigeria, it becomes very necessary to exploit feed ingredients of lower cost and sound biological values that can help supplement the costly conventional protein sources. Leaf meal supplementation have been included into the diets of poultry as means of reducing high cost of conventional protein sources and to improve profit margin (Odunsi *et al*., 1999; Iheukwumere *et al*., 2008; Nworgu *et al*., 2007; Emenalom *et al*., 2009; Fasuyi and Nonyerem, 2007 and Onyimonyi *et al*., 2009). The incorporation of protein from leaf sources in diets for broilers is fast gaining grounds because of its availability, abundance and relatively reduced cost. It had earlier been observed that leaf meal do not only serve as protein sources but also provide some necessary vitamins, minerals and also oxycarotenoids which causes yellow colour of broiler skin, shank and egg yolk (D'Mello *et al*., 1987; Opara, 1996).

Pawpaw '*Carica papaya*' is a plant native to tropical America. It is known as *okwuru bekee* in Igboland, '*Gonda*' in Hausa and *Ibepe* in Yoruba speaking areas of Nigeria. It is popular in the tropics and subtropics because of its easy cultivation, rapid growth quick economic returns and adaptation to diverse soils and climates (Harkness, 1967; Campbell, 1984). The fruit is high in vitamins (A, B_1, B_2, C) and minerals (Ca, K, P, Fe) low in sodium, fat and calories and contains practically no starch (Yadava *et al*., 1990; IIHR, 1979). Papaw latex contains four identified proteotytic enzymes (Papain, Chymopapain A and B and Papaya peptidase A (Yadava *et al*., 1990). Pawpaw plant is the most natural source of papain, an effective natural digestive aid which breaks down protein and cleanses the digestive tract (Poulter and Caygill, 1985). Pawpaw leaf has been used in ethnomedicine application for the treatment of several ailments in Nigeria. In view of its relative abundance in the study area, the present study was designed to evaluate the performance, carcass and organoleptic characteristics of finishing broilers fed pawpaw leaf meal.

MATERIALS AND METHODS

This study was carried out at the Poultry unit of the Department of Animal Science Teaching and Research Farm, University of Nigeria, Nsukka.

Sixty 5 weeks old broilers of mixed sexes belonging to the Anak Strain were selected from a pool of eighty birds that were previously brooded and reared from day old to the end of the 4th week following standard procedure and strict biosecurity measures. The sixty birds were

randomly assigned to four treatments with fifteen birds per treatment in a Completely Randomized Design on basis of vigor. Each treatment was further replicated thrice with five birds per replicate. Each replicate was housed in a deep litter pen measuring 1 m x 1.5 m. Fresh pawpaw leaves were harvested from pawpaw plants in the Departmental farm. The fresh leaves were dried on bare floor in a green house at the Department of Crop Science Teaching and Research Farm and allowed to dry for 6 days until it became crispy while still retaining its greenish colouration. The dried leaves were milled to fine particle size using an attrition mill. The milled pawpaw leaves were incorporated into the diets at 0.5, 1.5 and 2.0% in treatments 2, 3 and 4 respectively. Treatment 1 had no PLM and served as the control. The diets were isonitrogenous and isocaloric containing 21% CP and 2800 KcalME/kg (Table 1). The birds received feed and water *ad libitum* for the 28 days the feeding trial lasted (ie 29^{th}-49^{th} day of birds life). Initial weights of the birds were taken at the start of the experiment and weekly thereafter. Feed intake and mortality were recorded over the period. On the 49^{th} day of the birds life, three birds per treatment (one per replicate) were randomly picked and processed for carcass and organ studies in line with earlier procedure (Ugwu and Onyimonyi, 2008).

Table 1: Percentage composition of the diets

	Treatments			
Ingredients	1	2	3	4
Pawpaw leaf meal	-	0.5	1.5	2.0
Maize	7.0	7.0	7.0	7.0
Cassava chips	40.0	40.0	40.0	40.0
Groundnut cake	25.0	24.5	23.5	23.0
Palm kernel cake	19.0	19.0	19.0	19.0
Fish meal	5.0	5.0	5.0	5.0
Bone meal	3.0	3.0	3.0	3.0
Common salt	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Vitamin mineral premix*	0.25	0.25	0.25	0.25
Total	100	100	100	100
Determined analysis				
Moisture	12.20	11.00	12.80	10.00
Crude protein	20.66	21.37	21.42	21.16
Crude fibre	4.90	5.12	5.27	5.38
Ash	10.03	10.02	10.49	10.62
Ether extract	0.20	1.20	2.00	1.40
Nitrogen free extract	52.01	51.29	48.02	51.44

*Provided the following per kg of feed: vitamin A, 10, 000 iμ; vitamin D_3, 2000 iμ; vitamin E, 6 iμ; vitamin K, 2mg; riboflavin, 4.2 mg; vitamin B_{12}, 0.01 mg; pantothenic acid, 5 mg; nicotinic acid, 20 mg; folic acid, 0.5 mg; choline, 3 mg; Fe, 20 mg, mg, 56 mg; Cu, 1.0 mg; Zn, 5.0 mg; Co, 1.25 mg; Iodine, 0.8 mg

Data obtained from the response variables were subjected to a one way analysis of variance (ANOVA) according to the procedure of Steel and Torrie (1980). Significantly different means were separated using the method of Duncan (1955). Proximate composition of the PLM and the diets were performed using the procedure of AOAC (1990).

RESULTS AND DISCUSSION

The result of the proximate composition of the PLM is presented in Table 2. Result show that the crude protein of PLM is 30.12%. This value exceeds the 17.3% crude protein value reported for *microdesmis puberula* by (Esonu *et al*., 2002), 25.10% crude protein value for cassava leaf meal reported by (Iheukwumere *et al*., 2008), 24.06% crude protein for neem leaf meal reported by (Onyimonyi *et al*., 2009) and 22.34% crude protein value for mucuna leaf meal reported by (Emenalom *et al*., 2009). The high crude protein value of PLM further suggests its utilization as a protein supplement in diets for finishing broilers. The crude fibre of PLM is 5.60% which is lower than the 24.8, 11.40, 12.00 and 12.93% observed for *microdesmis puberula*, cassava leaf meal, neem leaf meal and mucuna leaf meal by (Esonu *et al*., 2002; Iheukwuemere *et al*., 2008; Onyimonyi *et al*., 2009 and Emenalom *et al*., 2009) respectively. The relative low crude fibre of PLM makes it a potential feed stuff for monogastrics that ordinarily have little capacity to digest fibre. The result of the performance characteristics of the birds are shown on Table 3. Results show that the effect of treatments on final body weight (g/b), weight gain (g/b), daily weight gain (g/b/d), feed conversion ratio and feed cost/kg gain were significant ($P<0.05$). The birds on T_4 showed superiority in all these parameters. The daily weight gain of birds on T_4 is 58.4 which significantly differed ($P<0.05$) from the value of 47.14, 50.07 and 54.64 recorded for birds on the control, T_1, T_2 and T_3 respectively. The same birds on T_4 had a feed conversion ratio of 2.30 which differed ($P<0.05$) from a value of 2.80 and 2.64 recorded for birds on the control and T_2 respectively but was not significantly different ($P<0.05$) from the 2.45 recorded for birds on T_3. The feed cost/kg gain of birds on T_4 (N138.42) differed significantly ($P<0.05$) from the value of N167.28 and N148.15 recorded for birds on control (T_1) and T_2 respectively but did not differ significantly ($P>0.05$) from the N141.05 observed for birds on T_3. The improved performance observed as level of PLM in the diets increased is a departure from the earlier opinion that at high levels of leaf meal inclusion, growth is depressed (Opara, 1996; Iheukwumere *et al*., 2008). The improved performance of the birds as level of

Table 2: Proximate composition of PLM

Component	Percentage
Moisture	10.20
Crude protein	30.12
Crude fibre	5.60
Ether extract	1.20
Ash	8.45
Nitrogen free extract	44.43

Table 3: Performance characteristics of finishing broilers fed PLM

	Treatment				
Parameters	1	2	3	4	SEM
Initial body weight (g/b)	962.5	960.0	962.5	960	1.73
Final body weight (g/b)	2612.5^{c}	2785.0^{b}	2875.0^{b}	2972.5^{a}	2.35
Weight gain (g/b)	1650.0^{c}	1752.5^{b}	1912.5^{b}	2044.0^{a}	0.39
Daily weight gain (g/b/d)	47.14^{c}	50.07^{b}	54.64^{b}	58.4^{a}	1.39
Feed intake (g/b/d)	131.97	132.11	134.07	134.23	0.80
Feed conversion ratio (feed/gain)	2.80^{a}	2.64^{b}	2.45^{c}	2.30^{c}	0.12
Feed cost/kg gain (Naira)	167.28^{a}	148.15^{b}	141.05^{c}	138.42^{c}	2.74

^{abcd}Row means with different superscripts are significantly different (P<0.05)
SEM = Standard Error of Mean; g/b = gramme per bird; g/b/d = gramme per bird per day

Table 4: Carcass and organ characteristics of broilers fed varying levels of PLM

	Dietary levels of PLM				
Parameters	1	2	3	4	SEM
Live weight (g)	2600^{c}	2750^{b}	2800^{b}	2970^{a}	2.30
Dressed weight	1786^{c}	1946^{b}	1986^{b}	2168^{a}	1.72
Dressing %	68.69^{b}	70.76^{b}	70.92^{b}	72.99^{a}	0.89
Gizzard (%	1.79	1.80	2.00	2.10	0.05
Liver (%)	1.63	1.82	2.14	2.52	0.10
Heart (%)	0.44	0.47	0.48	0.50	0.38

^{abc}Row means with different superscripts are significantly different (P<0.05)

Table 5: Organoleptic indices of meat of finishing broilers fed varying dietary levels of PLM

	Dietary Treatments				
Parameters	1	2	3	4	SEM
Colour	6.00^{c}	11.00^{b}	13.25^{b}	19.75^{a}	1.55
Taste	11.75	10.75	12.25	12.75	0.41
Tenderness	10.50^{b}	11.50^{b}	12.75^{b}	15.25^{a}	0.70
General acceptability	10.50^{c}	12.00^{b}	13.75^{a}	14.00^{a}	0.58

^{abc}Row means with different superscripts are significantly different (P<0.05)

PLM in the diets increased may be closely related to its crude protein content and its relatively low fibre. It could also be that the papain in PLM did aid protein digestion thus enhancing the release of free amino acids necessary to enhance growth. This view is in line with earlier view of Poulter and Caygill (1985), that papain is an effective natural digestive aid which breaks down protein and cleanses the digestive tract. Also the level of incorporation at a maximum of 2% is a complete turn from the very high inclusion observed in earlier works (Esonu *et al*., 2002; Iheukwumere *et al*., 2008; Ekenyem and Madubuike, 2006). Leaf meal supplementation in poultry rations has been proved to be a means of reducing cost and improving profit margin (D'Mello, 1995; Odunsi *et al*., 1999). The observed significant reduction in feed cost/kg gain as level of PLM increased agrees with this view. The carcass and organ characteristics of the birds are shown in (Table 4). Treatment effect on dressed weight, dressing percentage and liver weight (as percentage of body weight) were significant (P<0.05). There was an increase in the values of these parameters as levels of PLM in the diets increased. The birds on the 2.0% PLM (T_4) showed superiority above other birds in these parameters. The superior value of the dressing percentage of birds on T_4 is an indication that total edible meat from birds on this treatment is higher than the meat yield from other treatments. Carcass quality increases in response to nutrient profile. The organoleptic indices of the birds are presented in (Table 5). The striking finding in the organoleptic evaluation is the significant increase in tenderness of the meat of broilers fed 2% PLM (T_4). Pawpaw leaf contains papain which is employed as a tenderizer in cooking meat. The significant improvement in colour as level of PLM increased agrees with earlier report that leaf meals contain oxycarotenoids which impact yellow colour to broiler meat (Opara, 1996). The significant general acceptability of meat of broilers fed PLM is a further confirmation that the eating quality of the meat of the birds on PLM has been greatly improved.

Conclusion: Pawpaw leaf meal incorporated at 2% level in the diet of finishing broilers improves performance, carcass and organoleptic indices of the birds. Broilers at this level of PLM inclusion also bring more economic returns to the farmer as evidenced by the significantly lower feed cost/kg gain.

REFERENCES

A.O.A.C, 1990. Association of Official Analytical Chemists. Official methods of analysis. 15th Edn., Washington, D.C.

Campbell, C.W., 1984. Papaya-Tropical fruits and nuts. In: F.W. Martin (Ed.). Handbook of tropical food crops. CRC Press Inc: Boca Raton, Fl. pp: 246-247.

D'Mello, J.P.F., 1995. Leguminous leaf meals in Non-ruminant nutrition. In: Tropical legumes in Animal Nutrition. 1st Edn. Wellingfox, Oxon, A.B Int; pp: 247 -280.

D'Mello, J.P.F., T. Acamovic and A.G. Walker, 1987. Evaluation of Leucaena leaf meal for broiler growth and pigmentation. Trop. Agri. (Trinidad), 64: 33-35.

Duncan, D.B., 1955. New Multiple Range Test. Biometrics, 11: 1-42.

Ekenyem, B.U. and F.N. Madubuike, 2006. An assessment of *Ipomea asarifolia* leaf meal as feed ingredient in broiler chick production. Pak. J. Nutr., 5: 46-50.

Emenalom, O.O., B.O. Esonu, E.B. Etuk and C. Anaba, 2009. Effect of *Mucuna pruriens* (Velvet Bean) leaf meal on performance and blood composition of finisher broiler chickens. Nig. J. Anim. Prod., 36: 52-60.

Esonu, B.O., F.C. Iheukwumere, O.O. Emenalom, M.C. Uchegbu and E.B. Etuk, 2002. Performance, nutrient utilization and organ characteristics of broilers fed *Microdesmis puberula* leaf meal. Retrieved 03/07/09 from http://www.cipav.org.co/ird/irrd14/6/eson146/htm.

Fasuyi, A.O. and A.D. Nonyerem, 2007. Biochemical, nutritional and haematological implications of *Telfaria occidentalis* leaf meal as protein supplement in broiler starter diets. Afr. J. Biotechnol., 6: 1055-1063.

Harkness, R.W., 1967. Papaya growing in Florida. Florida Agric. Exp. Sta. Cir., pp: 5-100.

Iheukwumere, F.C., E.C. Ndubuisi, E.A. Mazi and M.U. Onyekwere, 2008. Performance, nutrient utilization and organ characteristics of broilers fed cassava leaf meal (*Manihot esculenta* Crantz). Pak. J. Nutr., 7: 13-16.

Indian Institute of Horticultural Research (IIHR), 1979. Papaya cultivation. Ext. Bul. 19. Bangalore. India.

Nworgu, F.C., S.A. Ogungbenro and K.S. Solesi, 2007. Performance and some blood Chemistry indices of broiler chicken served fluted pumpkin (*Telfaria occidentalis*) leaves extract supplement. Am.-Eurasian J. Agric. and Environ. Sci., 2: 90-98.

Odunsi, A.A., G.O. Farinu, J.O. Akinola and V.A. Togun, 1999. Growth, carcass characteristics and body compositions of broiler chickens fed wild flower (*Tithonia diversifolia*) forage meal. Trop. Anim. Prod. Invest., 2: 205-211.

Onyimonyi, A.E., Adeyemi Olabode and G.C. Okeke, 2009. Performance and Economic characteristics of broilers fed varying dietary levels of Neem leaf meal (*Azadirachta indica*). Int. J. Poult. Sci., 8: 256-259.

Opara, C.C., 1996. Studies on the use of *Alchornia cordifolia* leaf meal as feed ingredient in poultry diets. M.Sc Thesis, Federal University of Technology, Owerri, Nigeria, pp: 150-159.

Poulter, N.H. and J.C. Caygill, 1985. Production and utilization of papain-a proteolytic enzyme from *Carica papaya* L. Trop. Sci., 25: 123-137.

Steel, R.G.D. and J.H. Torrie, 1980. Principles and Procedures of Statistics. McGraw Hill Co. Inc. New York.

Ugwu, S.O.C. and A.E. Onyimonyi, 2008. Carcass, organ and organoleptic characteristics of spent layers fed bambara nut sievates. Int. J. Poult. Sci., 7: 81-84.

Yadava, U.L., A. Janice, Burris and D. McGary, 1990. Papaya: A Potential annual crop under middle Georgia conditions. In: J. Janick and J.E. Simons (Eds.), Advances in New Crops. Timber Press, Portland, pp: 364-366.