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The Performance of Broiler Birds Fed Varying Levels of Roasted Pigeonpea (*Cajanus cajan*) Seed Meal

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Abstract: Two experiments were carried out to investigate the effect of roasted Pigeonpea Seed Meal (PSM) on growth performance of broiler birds. Two hundred and forty day-old commercial unsexed broiler chicks (Anak strain) were used in experiment 1, while 168 four-week old broiler birds from experiment 1 were used in experiment 2. Birds in experiments 1 and 2 were divided into 6 groups. Experiment 1 birds were randomly assigned to six isoenergetic and isonitrogenous broiler starter diets containing 0, 6.5, 13.0, 19.5, 26.0 and 32.5% roasted PSM. Experiment 2 birds were also randomly assigned to 6 isoenergetic and isonitrogenous broiler finisher diets containing 0, 5.5, 10.5, 16.0, 21.5 and 27.0% roasted PSM. Parameters considered were weight gain, feed intake, feed conversion ratio, protein efficiency ratio, dressed carcass weight and carcass dressing percent. Results (Experiment 1) showed that there were significant differences ($p<0.05$) among treatments in average daily weight gain, average daily feed intake and feed conversion ratio. Feed intake, weight gain and efficiency of feed utilization declined at the 32.5% level of roasted PSM inclusion. However, there were no significant differences ($p>0.05$) among treatments in all the parameters considered in experiment 2. The results showed conclusively that roasted PSM can be included in broiler starter and finisher diets at 26% and 27% levels, respectively without any adverse effect on broiler birds.

Key words: Broiler birds, effect, growth performance, roasted pigeon pea seed meal

INTRODUCTION

There is much reliance on soybean meal and groundnut cake as the major conventional protein concentrates for feeding livestock in Nigeria and other developing tropical countries. This has led to increase in the prices of these feed ingredients and livestock feeds. Consequently the prices of animal products have escalated thereby making them out of reach of the common man. There is need, therefore, to search for alternative feedstuffs which are cheap and locally available. One of such alternative feedstuffs is pigeonpea [*Cajanus cajan* (L) Mill sp]. According to Adeparasi (1994), pigeonpea seed has low human food preference in Nigeria possibly because this pea requires a longer cooking period than the cowpea (*Vigna unguiculata*). Pigeonpea is locally available in most markets all over Nigeria. A wide variability exists in the chemical composition of pigeonpea seeds due to geographical location, cultivar, growth conditions and storage conditions (Salunkhe *et al*., 1985; Amaefule and Onwudike, 2000). Although the crude protein content of raw pigeonpea ranges from 17.9-30% (Faris and Singh, 1990; Obioha, 1992), the pigeonpea seed protein is deficient in sulphur amino acids and tryptophan but rich in lysine (Fetuga *et al*., 1973; Church and Pond, 1982; Enwere, 1998). Pigeonpea seed meal was tested in animal feeding studies and was found to be an acceptable protein source for rabbits, pigs and poultry (Nene *et al*., 1990; Amaefule and Obioha, 1998; Amaefule and Nwaokoro, 2002; Amaefule *et al*., 2004). However, pigeonpea seed contains such antinutritional factors like trypsin, chymotrypsin, polyphenolic compounds and amylase inhibitors which tend to inhibit the activity of digestive enzymes thereby causing digestive losses (Singh, 1988). However, treatment by heat has been established as an effective method of destroying these antinutritional factors (Salunkhe *et al*., 1985; Singh, 1993). Although pigeonpea seed meal has been used in poultry feeding, the effects of replacing soybean with pigeonpea seed in poultry ration have not been fully investigated in tropical poultry feed. This study therefore was conducted to determine the replacement value of Roasted Pigeonpea Seed Meal (RPSM) for soybean in broiler starter and finisher rations.

MATERIALS AND METHODS

The study, which involved two experiments, was conducted in the Poultry Unit of the Department of Animal Science Teaching and Research Farm, University of Nigeria, Nsukka. The pigeonpea and soybean seeds used in this study were purchased from Orba market, near Nsukka area of Enugu State in the South Eastern Agricultural Zone of Nigeria. To eliminate the antinutritional factors, the pigeonpea and soybean seeds were roasted at $112^{o}C$ for 30 min as

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Table 1: Percentage composition of broiler starter diets

	Dietary levels of pigeon pea seed meal (%)					
Ingredients	0	6.5	13.0	19.5	26.0	32.5
Maize	54.50	57.00	47.50	44.50	41.00	37.50
Soyabean	35.00	31.50	28.00	24.50	21.00	17.50
Pigeon pea	0.00	6.50	13.00	19.50	26.00	32.50
Fish meal	6.00	6.50	7.00	7.00	7.50	8.00
Bone meal	4.00	4.00	4.00	4.00	4.00	4.00
Iodized salt	0.25	0.25	0.25	0.25	0.25	0.25
Vit/min premix*	0.25	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00	100.00
Calculated composition						
Energy (MJ of ME/kg)	11.92	11.97	12.01	12.09	12.13	12.13
Crude protein (%)	24.15	24.16	24.07	24.07	24.06	24.00
Analyzed composition (%)						
Dry matter	91.60	91.10	92.54	92.52	92.22	91.44
Crude protein	24.08	24.05	24.03	24.03	24.06	24.04
Ether extract	5.50	5.25	5.00	5.05	5.35	5.06
Crude fibre	6.47	6.43	5.60	5.74	6.05	6.58
Ash	12.60	13.00	13.00	12.95	12.83	13.04
Nitrogen-free extract	51.35	51.27	52.37	52.23	51.71	51.28

*Vit A-10,000.00 iu., D_3 - 2,000 iu, B_1 - 0.75 g, B_2-5 g, Nicotinic acid-25 g, K_3 - 2.5 g, E-25 g, Biotin-0.05 g, Folic acid-1 g, Choline Chloride- 250 g, Cobalt-0.400 g, Copper 8 g, Manganese 64 g, Iron-32 g, Zn- 40 g, Iodine-0.8 g, Flavomycin-100 g, Spiramycin 5 g, 3-Nitro-50 g, DL-Methionine-50 g, Selenium 0.6 g, Lysine 120 g, BAT-5 g

Table 2: Percentage composition of broiler finisher diets

	Dietary level of roasted pigeonpea seed meal (%)					
Ingredients	0	5.5	10.5	16	21.5	27
Maize	615.00	58.50	55.50	52.50	49.50	46.50
Soybean	29.00	26.00	23.50	20.50	17.50	14.50
Pigeonpea	0.00	5.50	10.50	16.00	21.50	27.00
Fish meal	5.00	5.50	6.00	6.50	7.00	7.50
Bone meal	4.00	4.00	4.00	4.00	4.00	4.00
Iodized salt	0.25	0.25	0.25	0.25	0.25	0.25
Vit-Min-premix*	0.25	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00	100.00
Calculated analysis						
Crude protein (%)	21.03	21.01	21.08	21.05	21.03	21.00
Energy (MJ of ME/kg)	13.43	13.35	13.26	13.18	13.10	13.01
Determined analysis (%)						
Crude protein	21.05	21.03	21.10	21.07	21.04	21.02
Ether extract	5.80	6.40	5.98	6.05	5.85	6.25
Crude fibre	6.34	6.45	5.78	6.38	6.48	6.66
Ash	11.80	12.04	11.96	12.03	11.98	12.06
Moisture	7.50	7.89	6.46	6.58	7.44	7.92
Nitrogen-free extract	55.01	54.08	55.18	54.47	54.65	54.01
Cross energy (kcal/kg)	3400.00	3390.00	3250.00	3380.00	3360.00	3384.00

*Vit A-10,000.00 iu, D_3 - 2,000 iu, B_1-0.75 g, B_2 - 5 g, Nicotinic acid - 25 g, Calcium pantothenate 12.5 g, B_{12} - 0.015 g, K_3 - 2.5 g, E-25 g, Biotin- 0.050 g, Folic acid-1 g, Manganese 64 g, Choline chloride 250 g, Cobalt-0.8 g, Copper 8 g, Manganese 64 g, Iron- 32 g, Zn-40 g, Iodine-0.8 g, Flavomycin-100 g, Spiramycin 5 g, Dl-methionie-50 g, Selenium 0.6 g, Lysine 120 g, BAT-5 g

described by Jambunathan and Singh (1980) and Matanmi (1980). These feed ingredients were milled using a hammer mill and used to formulate the experimental diets.

Diets: In experiment 1 six isoenergetic and isonitrogenous diets were formulated to contain 0, 6.5, 13.0, 19.5, 26.0 and 32.5% roasted Pigeonpea Seed Meal (PSM) while in experiment 2, six isoenergetic and isonitrogenous diets containing 0, 5.5, 10.5, 16.0, 21.5 and 27% roasted PSM were formulated as shown in Table 1 and 2, respectively.

Birds and management: In experiment 1, 240 day old commercial broiler chicks (Anak strain) with initial average live weight of 54.39 g per chick were used in a Completely Randomized Design (CRD). The birds were randomly assigned to six treatment groups with forty birds per group. Each group was replicated 4 times with 10 birds per replicate placed in a 2.6 m x 3 m deep litter pen of fresh wood shavings for brooding. Heat was provided by kerosene stoves placed under metal hovers for 28 days. The chicks were properly vaccinated against New Castle and Gumboro diseases. Antibiotics and coccidiostats were also administered to them. From day old to 4 weeks of age, each group of chicks was randomly assigned to one of the isoenergetic and isonitrogenous broiler starter diets. Feed and water were provided to the birds *ad libitum* for the 28 d experimental period.

In experiment 2, one hundred and sixty eight birds with initial average live weight of 646.04 g per bird were used. The birds, which were selected from experiment 1 on the basis of vigour were randomly assigned to 6 treatment groups with 28 birds per group. Each group was replicated 4 times with seven birds per replicate placed on deep litter of fresh wood shavings in open sided house partitioned into pens measuring 2.6 m x 3 m. Each group of chicks was randomly assigned to one of the isoenergetic and isonitrogenous broiler finisher diets. Feed and drinking water were provided to the birds *ad libitum* for the 28d experimental period.

Data collection: Birds in each treatment were weighed at the beginning of the experiment and on weekly basis thereafter to determine the weight gain of birds. Feed intake was recorded daily and was determined by obtaining the difference between quantity of feed offered and the left over the following morning. Feed conversion ratio was calculated from the data on feed intake and weight gain as the number of grams of feed taken per gram of weight gained over the same period. At the end of the 8-week experimental period, 4 birds were randomly selected from each group for carcass evaluation. Each bird was starved overnight, weighed and slaughtered by cutting the jugular vein.

Proximate and statistical analyses: Experimental diets were analyzed for proximate composition according to AOAC (1990). The data collected were subjected to Analysis of Variance (ANOVA) for a CRD (Snedecor and Cochran, 1980) and differences between the treatment means were separated using Duncan New Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

Experiment 1: Data on the performance of the experimental birds are summarized in Table 3. There were significant ($p<0.05$) differences among treatments in Average Daily Feed Intake (ADFI), Average Daily Weight Gain (ADWG) and Feed Conversion Ratio (FCR), but there were no significant ($p>0.05$) differences among treatments in protein efficiency ratio, initial and final body weights of the birds. Birds on treatment 1 (0% roasted PSM) had the highest feed intake and weight gain which were similar ($p>0.05$) with the feed intake and weight gain of birds on treatments 2, 3, 4 and 5 (6.5, 13.0, 19.5 and 26.0% roasted PSM, respectively), but differed significantly ($p<0.05$) from the feed intake and weight gain of birds on treatment 6 (50% PSM). However, significant ($p>0.05$) differences did not exist among treatments 2, 3, 4, 5 and 6 (6.5, 13.0, 19.5, 26.0 and 32.5% roasted PSM, respectively) in feed intake and weight gain. Birds on treatment 1, also had the highest efficiency of feed conversion which did not differ significantly ($p>0.05$) from that of birds on treatments 2-5, but differed significantly ($p<0.05$) from that of birds on treatment 6. Birds on treatments 2, 3, 4 and 5 had similar ($p>0.05$) feed conversion ratio with birds on treatment 6. There was no death of chicks in all the treatments.

The results of the feeding trial (Table 3) revealed that feed intake, weight gain and efficiency of feed utilization declined at the 32.5% level of roasted PSM inclusion in the diet. This finding is consistent with that of Amaefule and Onwudike (2000). Amaefule and Nwaokoro (2002) made similar observation. It was observed that the pigeonpea based diet became less palatable as the level of inclusion increased beyond 26%. This may probably explain the observed depression in feed intake. Adeparasi (1994) reported that the acid taste of the pigeonpea seed coat affects the palatability of the meal. The cooking water therefore has to be changed several times to make the final product palatable. The problem of palatability is therefore critical to increased feed intake in pigeonpea based diet. The authors are of the opinion that dehulling and boiling of the seeds may help to alleviate the problem of reduced feed intake associated with the feeding of higher levels of PSM. Feed intake is

Table 3: Performance of broiler starter chicks fed different levels of pigeon pea seed meal

	Dietary levels of pigeon pea seed meal (%)						
Parameters	0	6.5	13.0	19.5	26.0	32.5	SEM
Initial body weight (g)	54.85	54.00	55.75	53.75	54.25	53.75	1.21
Final body weight (g)	521.43	532.14	482.86	525.00	525.10	471.40	29.90
Average daily weight gain (g)	17.86^{a}	16.44^{ab}	15.65^{ab}	14.17^{ab}	13.64^{ab}	12.85^{b}	2.16
Average daily feed intake (g)	28.31^{a}	25.15^{ab}	25.10^{ab}	24.85^{ab}	24.30^{ab}	22.30^{b}	4.05
Feed conversion ratio (feed (g)/gain (g))	1.43^{b}	1.56^{ab}	1.65^{ab}	1.77^{ab}	1.77^{ab}	2.02^{a}	0.23
Protein efficiency ratio (gain (g)/protein consumed (g))	2.62	2.73	2.58	2.37	2.36	2.38	0.12
Mortality (%)	0.00	0.00	0.00	0.00	0.00	0.00	-

^{a,b}Means not followed by the same superscripts on the same row are significantly ($p<0.05$) different. SEM: Standard Error of the Mean

Table 4: Effect of roasted pigeonpea seed meal on performance of broiler finishers

	Dietary level of roasted pigeonpea seed meal (%)						
Parameters	0	5.5	10.5	16	21.5	27	SEM
Initial body weight (g)	662.50	618.75	662.50	621.25	662.50	648.75	±47.24
Final body weight (g)	1716.67	1650.00	1783.33	1700.00	1795.58	1765.67	±41.11
Avg. daily feed intake (g)	100.23	101.96	105.44	96.02	94.75	96.29	±10.75
Avg. daily weight gain (g)	48.96	43.93	50.40	47.70	55.07	51.43	±8.80
Feed conversion ratio	2.05	2.32	2.09	2.01	1.72	1.87	±0.28
Protein efficiency ratio	2.32	2.03	2.49	2.33	2.27	2.07	±0.2348
Dressed weight (g)	1216.67	1116.67	1166.67	1116.67	1250.00	1233.33	±1.73
Dressing (%)	70.87	67.68	65.42	65.69	65.22	68.52	±3.35

Means not followed by the same superscripts on the same row are significantly ($p<0.05$) different

a major factor that influences weight gain. The decline in weight gain of birds that consumed the 32.5% PSM diet may be attributed to depressed feed intake and lower efficiency of feed utilization. The metabolic and production requirements of the birds could not be satisfied as the level of PSM in the diet increased with the resultant decline in feed intake. Okoye *et al*. (1997) made a similar suggestion. Growth depression had earlier been attributed to reduced feed intake (Plavinik *et al*., 1981). The results obtained showed that birds on treatments 2-5 (6.5-26% PSM) had similar growth performance with birds on the control diet and with those on treatment 6 (32.5% PSM).

Experiment 2: Data on the performance of broiler finishers fed roasted PSM at varying levels of dietary inclusion are presented in Table 4. There were no significant differences ($p>0.05$) among treatments in all the parameters considered. As shown in Table 4, there was no significant difference ($p>0.05$) in weight gain. This result contradicts that of Etuk *et al*. (2002) which showed that there was a significant ($p<0.05$) depression in weight gain among birds fed diets containing 20-50% cooked pigeonpea seed meal.

The result obtained in this study seems to suggest that broiler finishers can be fed diets containing more than 26% roasted PSM without any observed weight depression. Amaefule and Obioha (1998) and Amaefule *et al*. (2004) made a similar observation. It was observed (Table 4) that there were no significant ($p>0.05$) differences among treatments in feed intake. The result obtained in the present study showed an improvement over the observation of Ani and Okeke (2000) that broiler starters fed 27% roasted PSM had significantly ($p<0.05$) lower feed intake than birds fed 5.5-21.5% roasted PSM diets. Perhaps broiler finishers are more adapted to high intake of pigeonpea seed meal than broiler starters. The increased feed consumption by birds on roasted PSM diets also suggests that roasting for 30 min was able to eliminate the anti-nutritional factors in pigeonpea (Jambunathan and Singh, 1980; Singh, 1993). It could be observed (Table 4) that there were no significant ($p>0.05$) differences among treatments in Feed Conversion Ratio (FCR) and Protein Efficiency Ratio (PER). This would have led to the similarity in weight gain, final body weight, dressed carcass weight and carcass dressing percent observed among birds fed varying dietary levels of roasted PSM. This agrees with the reported findings of Grimaud (1988). The results obtained in this study strongly indicate that up to 27% roasted PSM may be incorporated into broiler finisher diets without any deleterious effect on growth performance of broiler birds.

Conclusion: The results of this study show that roasted pigeon seed meal can be included in broiler starter and finisher diets at 26% and 27% levels, respectively, without deleterious effect on growth performance of broiler birds. At such levels of inclusion, roasted PSM can replace 40% of soybean and 31.19% of maize in broiler starter diets, while 50% of soybean and 24.39% of maize can be replaced in broiler finisher diets.

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REFERENCES

Adeparasi, E.O., 1994. Evaluation of the nutritive potential of cooked pigeonpea (*Cajanus cajan*) meal as a plant protein source for *Clarias gariepinus* finger lings. J. Agric. Technol., 2: 48-57.

Amaefule, K.U. and F.C. Obioha, 1998. The substitution of pigeonpea (*Cajanus cajan*) seed for groundnut cake and maize in broiler finisher ration. Nig. J. Anim. Prod., 25: 9-12.

Amaefule, K.U. and O.C. Onwudike, 2000. Comparative evaluation of the processing methods for pigeonpea seeds (*Cajanus cajan*) as protein source for broilers. J. Sustain. Agric. Rural Environ., 1: 134-136.

Amaefule, K.U. and C.C. Nwaokoro, 2002. The effect of graded levels of raw pigeon pea (*Cajanus cajan*) seed meal on the performance of weaner rabbits. Proc. 27th Ann. Conf. Nig. Soc. for Anim. Prod. (NSAP), March 17-21, 2002, Fed Univ. of Tech., Akure, Nigeria, pp: 113-115.

Amaefule, K.U., C.C. Nwaokoro and F.C. Iheukwumere, 2004. The effect of feeding graded levels of raw pigeon pea seed (*Cajanus cajan*) meal on the performance, nutrient retention and carcass characteristics of weaner rabbits. Nig. J. Anim. Prod., 31: 194-199.

Ani, A.O. and G.C. Okeke, 2000. The feeding value of pigeonpea (*Cajanus cajan*) seed meal to broiler starter chicks. Proc. of 7th Annual Conf. of Anim. Ass. Nig., Sept. 16th-19th, 2002. University of Agriculture, Abeokuta.

AOAC, 1990. Association of Official Analytical Chemists, Official Methods of Analysis, 15th Edn., Washington DC.

Church, D.C. and W.G. Pond, 1982. Basic Animal Nutrition and Feeding. 3rd Edn., John Wiley and Sons Publishers, New York, USA., pp: 472.

Duncan, D.B., 1955. Multiple Range and Multiple F-Tests. Biometrics. 11: 1- 42.

Enwere, N.J., 1998. Foods of Plant Origin. Afro-Orbis Pub. Ltd., Nsukka, Nigeria, pp: 301.

Etuk, E.B., A.B.I. Udedibie and H.O. Obikaonu, 2002. Replacement value of cooked pigeonpea (*Cajanus cajan*) seed meal for soybean meal and maize in broiler finisher diet. Proc. of 7th Annual Conf. of Anim. Ass. Nig., Sept. 16th-19th, 2002, University of Agriculture, Abeokuta.

Faris, D.G. and U. Singh, 1990. Pigeonpea nutritive and products. In Y.L. Nene *et al.* (Eds). The Pigeonpea Patancheru, A.P. 502324, India ICRISAT, pp: 467.

Fetuga, B.L., G.M. Babatunde and V.A. Oyenuga, 1973. Protein quality of some Nigerian feedstuffs. 1. Chemical assay of nutrients and amino acid composition. J. Sci. Food Agric., pp: 1505-1514.

Grimaud, P., 1988. The pigeonpea (*Cajanus cajan*): A possible alternative for traditional pig and poultry farming in New Caledonia. Revue-d'Elevage-et-Medecine-Veterinaire-de-N Ouvelle Caledonie, 11: 29-36.

Jambunathan, R. and U. Singh, 1980. Grain quality of pigeonpea. International Workshop on Pigeonpea, ICRISAT, 1: 351-356.

Matanmi Opes, K., 1980. Evaluation of heated soyabean meal using cresol red technique. Nig. J. Amin. Prod., 7: 87-92.

Nene, Y.L., D.S. Hall and V.K. Sheila, 1990. The Pigeonpea CAB International, Wallingford, Oxon, UK., pp: 1-13.

Obioha, F.C., 1992. A Guide to Poultry Production in the Tropics. Acena Pub. Enugu, Nigeria.

Okoye, F.C, F.C. Obioha and G.C. Okeke, 1997. Substitution of dried brewer's yeast for fish meal in the diet of broiler chicks. J. Agric. Tech., 5: 34 -40.

Plavinik, I., S. Bounstain and S. Hurwitz, 1981. Evaluation of methanol-grown bacteria and hydrocarbon - grown yeast as sources of protein for poultry: Studies with young chicks. Br. Poult Sci., 13: 207-272.

Salunkhe, D.K., S.S. Kadam and J.K. Chavan, 1985. Post harvest Biotechnology of Food Legumes: CRC Press Inc. Boca Raton, Florida, USA.

Singh, U., 1988. Antinutritional factors of chickpea and pigeonpea and their removal by processing. Plant Foods for Human Nutr., 38: 251-261.

Singh, U., 1993. Protein quality of pigeonpea (*Cajanus cajan* (L). Mill sp.) as influenced by seed polyphenols and cooking process. Plant Foods Human Nutr., 43: 171-179.

Snedecor, G.W. and W.G. Cochran, 1980. Statistical methods (7th Edn.). The Iowa State University Press, Aves, Iowa, USA.