PAT 2009; 5 (1): **67-74** ISSN: 0794-5213

Online copy available at

www.patnsukjournal.net/currentissue

Publication of Faculty of Agriculture, Nasarawa State University, Keffi

The Replacement Value of Pigeon Pea (*Cajanus Cajan)* For Maize on Performance of Broiler Finishers

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Abstract

One hundred and fifty, 4-weeks old unsexed broiler chickens were used in a 28 day trial to evaluate the effect of replacing maize with pigeon pea in broiler finisher diets. The birds were randomly allocated to 5 dietary treatments with each treatment having 30 birds replicated three times. Each replicate contained 10 birds. Diet 1 was formulated without pigeon pea and served as control. Pigeon pea replaced on weight to weight basis, 25, 50, 75 and 100% respectively of the maize in the control diet to give diets 2, 3, 4 and 5. Feed intake, weight gain, feed conversion ratio, carcass yield and feed cost/kg gain were determined to compare treatment means. Results obtained for diets 1, 2, 3, 4 and 5 showed that feed intake (114.99 g, 104.29 g, 114.17 g, 108.71 g and 105.03 g) weight gain (38.65 g, 39.85 g, 38.18 g, 37.69 g and 31.69 g) and feed conversion ratio (2.98, 2.62, 2.99, 2.88 and 3.32) of birds on all dietary treatments were comparable. Carcass yield of birds on 100% replacement level (52.62%) was significantly (P<0.05) lower than the other replacement levels (69.13, 67.83, 69.66 and 67.41% respectively for 0, 25, 50 and 75% replacement levels). Feed cost/ kg gain decreased linearly with increased level of replacement. 100% replacement level was the most expensive in terms of feed cost/ kg gain (₦299.84) compared to the control (₦260.69). It can be concluded from the results of this study that pigeon pea can replace up to 75% of maize in broiler finisher diets without negatively affecting performance and carcass yield

Keywords: *Replacement value, pigeon pea, broiler finishers, performance, carcass yield.*

Introduction

Maize has been playing a key role as a source of energy in poultry diets. Its demand far outstrips its supply because it is also used as a major human food and for various industrial raw materials (Udedibie and Asoluka, 2008). Bamgbose *et al* (2004) stated that Maize accounts for 45-55% of poultry feed, therefore any effort to substitute it will significantly reduce the cost of production. The escalating cost of maize is one of the stimulants for the continuing search for alternative feedstuff. Several attempts to reduce cost of poultry feed by replacing maize with ingredients like full fat palm kernel meal, full fat cashew nut rejects, *Anthonata macrophyla* meal and cooked pigeon pea seed meal have been made (Ugwuene *et al.,* 2005; Sogunle *et al.,* 2005; Durunna *et al*., 2005 and Etuk and Udedibie, 2006).

Pigeon pea (*Cajanus cajan)* is one of the most common legumes of the tropics and sub-tropics with a wide adaptability (Wallies and Byth, 1988). Rachie (1975) reported that pigeon pea is a legume that shows great potential in Nigeria and to which efforts of the International Institute of Tropical Agriculture (IITA) were directed for improvement. Pigeon pea is truly a multipurpose nitrogen fixing plant that provides food, fuel wood, fodder and shelter material to subsistence farmers. The seeds can be used as animal feed and harvest trash consisting of shells, leaf and young stems has good fodder value. Pigeon pea is drought tolerant and has greater adaptability to poor soil conditions than most tropical legumes (Akinola and Oyejola, 1994). It is widely cultivated throughout the tropics as a cover crop or green manure crop and it has high dry matter yield potential. Aduku (1993) gave the nutritional composition of pigeon pea seed as: 23.77% CP, 1.1% fat, 7.49% CF, 0.13% Ca, 0.28% P, 1.66% lysine, 0.36% methionine, 0.29% cystein, 1.59% arginine and 0.11% tryptophan. Pigeon peaôs low food value for humans due to low palatability when compared to cowpea and prolonged cooking time, coupled with no industrial use in Nigeria as of now (Amaefule and Obioha, 2001), qualifies it as a suitable replacement for maize. Iorgyer *et al* (2008) replaced 0, 25, 50, 75 and 100% of weaner rabbit diets with pigeon pea and recorded no significant ($P>0.05$) difference among treatments on rabbit performance. They however reported feed cost /kg gain on pigeon pea based diets to be significantly ($P<0.05$) lower than the control.

This study was designed to investigate the replacement value of pigeon pea for maize on the performance, carcass yield and the economy of producing broiler finisher chickens.

Materials and Methods

Experimental Site

This trial was carried out at the Poultry unit of the Department of Animal Health and Production, Akperan Orshi College of Agriculture, Yandev, Benue State, Nigeria.

Experimental Diets

Pigeon pea seeds were boiled for 30 minutes, sun dried and then coarsely milled before incorporation into the diets. Five broiler finisher diets were formulated with the control without pigeon pea (Diet 1). Diets 2, 3, 4 and 5 had 25, 50, 75 and 100% respectively of the maize in the control diet replaced with pigeon pea on weight to weight basis.

Experimental Animals

One hundred and fifty (150) unsexed 4- week old broiler chickens were randomly allocated to 5 dietary treatments in a Complete Randomized Design (CRD) with each treatment having 3 replicates of 10 birds per replicate.

Experimental Procedure

The poultry house was cleaned, washed, disinfected and dried before use. Birds were individually weighed at the commencement of the trial and subsequently on weekly basis to monitor their weight. Birds were given their group diet and water adli bitum. Left over feed was weighed and subtracted from the feed served to arrive at feed intake. At the end of the 28 day study, 3 birds weighing close to their pen average were starved overnight, sacrificed by severing the jugular vein with a sharp knife and allowed to bleed by gravity. They were scalded, defeathered, envicerated and weighed to obtain dressed weight.

Parameters Measured

Mean daily feed intake (g), Mean daily weight gain (g), feed conversion ratio (g feed/ g gain), carcass yield (dressing percentage ,%), feed cost/ kg (₦/kg) and feed cost/ kg gain (₦/kg), were the parameters measured to compare treatment means.

Proximate Analysis

Samples of the test material (pigeon pea, raw and boiled) and experimental diets were analysed chemically for proximate components according to AOAC (1990). All analysis was carried out in duplicate.

Data Analysis

Data collected were subjected to ANOVA for Complete Randomized Design (CRD). Differences between treatments were separated using Hsuôs MCB (Multiple Comparable with the Best) method (MINITAB, 1991).

Results and Discussion

The nutritional characteristics of pigeon pea and the experimental diets are in Tables 1 and 2 respectively. Pigeon pea had high dry matter content. The metabolizable energy (ME Kcal/kg) of the raw seed was very high (3265) which was further increased with boiling to 3355. The metabolizable energy of pigeon pea is close to that of maize (3400 kcal/kg, Aduku, 1993), therefore qualifies it as a suitable replacement for maize as energy source in poultry diets. Considering the percent ingredient composition of the tests diets, crude protein and other nutrients (both in determined and calculated analysis) increased while energy decreased as the level of replacement increased. This could be probably because pigeon pea has higher crude protein and other nutrients and lower energy than maize (Aduku, 1993). However both calculated and determined values are within the range of nutrient requirement of broiler finishers according to Aduku (1993) and Olomu (1995).

The performance, meat yield and economics of producing broiler finishers on tests diets are in Table 3. Feed intake, weight gain and feed conversion ratio of birds on pigeon

pea containing diets were not significantly (P>0.05) different from those on the control diet. Birds are known to eat to meet their energy requirements, and since the energy levels of all the diets in this study were similar, feed intake of birds were also similar. The similarity in the feed intake, weight gain feed conversion ratio of birds on all diets in this study is an indication that pigeon pea is not inferior to maize. This agrees with Amaefule and Obioha (1998) that broiler finishers can perform well with up to 50% of pigeon pea seed meal in their diets. This result however differed from results of Grimaud (1988) and Ologbobo (1992), who reported depressed growth rate, increased feed intake and poor feed conversion efficiency of broilers fed with above 25% level of boiled pigeon pea seed meal in their diets.

Significant differences were observed in live weight of birds with birds on 0% replacement level being significantly (P<0.05) heavier than the birds on 25% and 100% replacement levels. Dressed weight of birds on 0, 25, 50 and 75% replacement levels are comparable but significantly (P<0.05) higher than those birds on 100% replacement level. Carcass yield of birds on 100% replacement level were significantly (P<0.05) lower than other replacement levels. This result agrees with findings of Ugwuene *et al.* (2005) who studied the effect of replacing maize with full fat palm kernel meal in broiler starter diets. These researchers reported performance of birds on 80 and 100% replacement diets to be significantly (P<0.05) lower than all replacement levels.

Feed cost/ kg decreased linearly with increased level of replacement. At the time of this trial, the cost of various feed ingredients put the cost per kilogram of the test diets at ₦87.48, ₦84.91, ₦82.35, ₦79.78 and ₦77.22 for diets 1, 2, 3, 4 and 5 respectively. This is because pigeon pea was costing lower than maize at the time of this study. This agrees with Ugwuene *et al* (2005). The costs of producing 1 kg gain from 25-75% replacement levels were cheaper than the control as ₦38.23, ₦14.46 and ₦30.92 respectively were saved. 100% replacement level happened to be the most expensive in terms of feed cost/ kg gain being ₦39.15/ kg more expensive than the control. In a large scale broiler enterprise, a saving of ₦1.00 (one naira) in feed cost of producing a kilogram of broiler is quite significant (Tuleun *et al* 2005).

The poor performance of birds on 100% replacement level compared with other replacement levels agrees with findings of Esonu and Udedibie (1993) and Ogbonna and Adebowale (1993) and Ugwuene *et al* (2005) on maize replacement trials.

Conclusion

The results of this trial suggest that replacing maize with 75% pigeon pea in broiler finisher diets will give good and profitable results. It is therefore concluded that whenever the price of pigeon pea is lower than maize, farmers and feed millers can use pigeon pea to replace up to 75% of maize in broiler finisher diets, as a way of reducing

the current demand pressure on maize and also reducing the cost of broiler finisher diets.

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Table 1: *Proximate composition of pigeon pea seeds*

%	Raw	Boiled
Dry matter	88.69	89.73
Crude protein	21.25	19.86
Crude fibre	6.65	4.40
Crude fat	1.41	1.52
Ash	4.11	3.91
NFE	66.58	70.31
ME* (kcal/kg)	3265.00	3355.00

ME (kcal/kg) = 37 x %CP + 81.8 x % EE + 35.5 x %NFE (Pauzenga, 1985)
NFE determined by difference: NFE=100-(%CP+%CF+%EE+%Ash)

Table2: *Percent ingredient composition of broiler finisher diets Maize Replacement Level (%)*

Ingredients	0	25	50	75	100
Maize	51.31	38.48	25.65	12.83	-
Pigeon pea	-	12.83	25.66	38.48	51.31
Soyabeans	39.69	39.69	39.69	39.69	39.69
Rice offal	5.00	5.00	5.00	5.00	5.00
Bone meal	3.20	3.20	3.20	3.20	3.20
Salt	0.30	0.30	0.30	0.30	0.30
Premix	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00
Calculated values					
Crude protein (%)	20.00	21.41	22.82	24.23	25.34
Crude fibre (%)	4.84	5.14	5.45	5.76	6.09
Calcium (%)	1.27	1.36	1.30	1.31	1.33
Phosporus (%)	0.95	0.95	0.95	0.95	0.94
Lysine (%)	1.09	1.27	1.45	1.63	1.81
Methionine (%)	0.57	0.59	0.61	0.63	0.65
Meth + Cys (%)	0.86	0.90	0.94	0.98	1.01
ME (kcal/kg)	3120	3115	3109	3103	3095
Determined values					
Dry matter (%)	90.09	90.07	90.16	90.14	90.12
Crude protein (%)	20.31	20.33	20.52	20.44	20.67
Crude fat (%)	3.5	3.54	3.59	3.63	3.57
Crude fibre (%)	3.5	3.54	3.52	3.58	3.60
Ash (%)	6.01	6.10	6.16	6.22	6.20

Table 3: *The treatment effect of replacing maize with pigeon pea on performance, meat yield and economics of producing broiler finishers*

	Maize Replacement Level (%)					
Parameters	**0**	**25**	**50**	**75**	**100**	**SEM**
Initial live wt (g/bird)	461.36	458.50	456.30	450.57	453.30	-
Mean daily feed intake (g)	114.99	104.29	114.17	108.71	105.03	11.96
Mean daily wt gain (g)	38.65	39.85	38.18	37.69	31.67	9.64
Feed conversion ratio	2.98	2.62	2.99	2.88	3.32	1.07
Mean live weight (g)	1550.0^{a}	1400.0^{b}	1483.3^{ab}	1483.3^{ab}	1216.7^{c}	34.16
Mean dressed wt (g)	1071.7^{a}	950.0^{a}	1033.3^{a}	1000.0^{a}	713.3^{b}	28.46
Carcass yield (dressed %)	69.13^{a}	67.83^{a}	69.66^{a}	67.41^{a}	58.62^{b}	0.69
Feed cost (N/ kg)	87.48	84.91	82.35	79.78	77.22	-
Feed cost/ kg gain (N/ kg)	260.69	222.46	246.23	229.77	299.84	-
Saving on feed cost/kg Gain (N)	00.00	38.23	14.46	30.92	-39.15	-

^{a,b,c} *Means in a row with different superscripts are significantly (P<0.05) different*