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Performance of Grower Pigs Fed Boiled Pigeon Pea (*Cajanus cajan* (L.) Millsp.) Seed Meal Diets

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Abstract
Twenty-four growing pigs were used to determine the replacement value of boiled pigeon pea seed diets (PSM) for soybean and maize in pig diets. The inclusion levels of boiled PSM were 0, 20, 25 and 30 %. The experimental design was completely randomized design (CRD). There were four treatments each replicated thrice with two weaned pigs per replicate. Measurements were live weight, weight gain, feed intake, feed conversion ratio (FCR) and cost benefits. The experiment lasted for four months. Feed intake was not significantly ($p>0.05$) different among the treatments; although, pigs fed T4 had numerically higher values (0.80 kg) of these indices than pigs fed the other diets. Feed conversion ratio was higher with T1 (9.03) and showed a significant difference ($p<0.05$) between the treatments. Pigs fed T4 diet gave numerically higher value (0.16) of the daily protein intake and better protein efficiency ratio than pigs fed other diets. The cost per kg diet and daily feed cost were not significantly different ($p>0.05$) among the treatments but, pigs fed T1 diet had numerically higher values of these indices than pigs fed the other diets (N47.69 and 36.72) respectively. Cost/kg weight gain was significantly different ($p<0.05$) which T1 had a higher value (N430.64) of these indices than pigs fed other diets. It was concluded that boiled PSM could replace soybean and maize in growing pig diets and the inclusion level could be up to 30 % of the diet and it enhanced the feeding and the performance of pigs.

Keywords: Performance, grower pigs, boiled pigeon pea seed meal, diets.

Introduction

In various parts of the world, pig production has become highly specialized, hence large pig farms exist and have become widespread. Expansion and specialization have led to increase in the efficiency and volume of pork production and labour productivity (Aarnink *et al*., 2007). Pigs and pig keeping in one form or another can be found almost anywhere in the world. In rural areas, it is common to have pigs rooting and roaming freely around the dwellings, to be brought in one day as household needs require. Pig keeping enterprises are also to be found in and around towns and cities, and they play an important role in feeding urban populations. In the South-East and South-South zones of Nigeria, pig production and pork consumption are increasing, thus reducing the animal protein demand-supply gap. The reasons for this include prolificacy of pigs, fast growth early maturity, high meat yield and less of socio-cultural bias against pigs.

Pigeon pea (*Cajanus cajan* (L.) Millsp.) seeds have a great potential as an important protein source (Cheva-Isarakul, 1992; Oshodi *et al*., 1993) and every effort has been made to use pigeon pea meal (PM) for chicken (Amaefule and Obioha, 2005), pigs (Batterham *et al*., 1993) and lambs (Rao and Philips, 2001). However, the efficacy of PM is limited by the presence of protease inhibitors such as trypsin and chymotrypsin inhibitors (Batterham *et al*., 1993). To improve the nutritional quality of PM, these anti-nutritional factors can be eliminated by heating (Singh, 1988; Mekbungwam and Yamauchi, 2004), boiling (Rani *et al*., 1996), roasting (Simoongwe, 1998), extraction (Benjakul *et al*., 2000) and cooking (Aarti *et al*., 2001), resulting in improved protein and starch digestibility (Rani *et al*., 1996).

The protein content of commonly grown pigeon pea seeds has been reported to be 18-30 % (Amaefule and Obioha, 2005). High protein lines with up to 32.50 % protein content and high sulphur-containing amino acids (Cysteine and Methionine). The seed contains 51.40 - 58.80 % carbohydrates (Faris and Singh, 1990), 1.20-8.10 % crude fibre (Amaefule and Obioha, 2005). It is a good source of dietary minerals like calcium, phosphorus, magnesium, sulphur and potassium and water-soluble vitamins, especially thiamine, riboflavin and niacin (Salunkhe *et al*., 1986).

When the amino acid requirements of growing pigs are compared with the amino acid content of all legumes, legume seeds are generally good sources of lysine but deficient in both methionine and cystine, while tryptophan is marginally deficient (NRC 1998). Provided that the diet is supplemented with methionine, legume seeds are potential substitutes for soybean meal (SM) in the diets of monogastric animals. Untreated legume seeds, however, contain anti-nutritional factors (ANF) that are developed for the growth and protection of the legume, but depress animal production when ingested in excessive amounts.

Materials and Methods

The study was carried out in the piggery unit of the teaching and research farm of Michael Okpara University of Agriculture, Umudike which is geographically located in Abia State on latitude $05^{0}29^{l}$N,longitude $07^{0}33^{l}$Ea nd at an altitude of 122 m above sea level. It lies within the humid rainforest zone of West Africa (NRCRI, 2011). A total of twenty-four (24) growing pigs comprising of 12 males and 12 females were used for the study. The animals were randomly allotted to four (4) treatments; each

treatment was replicated thrice and each pen measured 2m x 7m housed replicate of two (male and female) pigs. The pigs were housed in a tropical-type, open-sided pig house roofed with asbestos roofing sheets. The open side of the house was covered with expanded metal and iron nets to prevent flies and other insects' entry in the piggery house. The pigs were provided experimental feed and water *ad libitum.* Routine medications (dewormer, antibiotics and multi-vitamin) were administered to the pigs during the experiments.

Water of about twenty-four (24) litres was kept on the fire and was allowed to boil (100^{0}C). The pigeon pea seeds were poured in the boiling water and it was allowed to boil for thirty (30) minutes; pigeon pea seeds were collected using a sieve, sun-dried and ground. Four experimental diets were formulated with boiled pigeon pea seed meal (PSM) included at four levels of 0, 20, 25 and 30 % of the whole diet. Each level of inclusion replaced part of soybean meal and maize in the diets. The diet of 0 % boiled PMS served as the control shown in Table 1.

Table 1: Percentage composition of boiled pigeon pea seed meal diets fed to weaner pigs.

Ingredients	Control	20 %	25 %	30 %
Pigeon pea seed meal	0.00	20.00	25.00	30.00
Maize	33.85	19.40	14.40	9.83
Soybean meal	7.95	2.40	2.40	1.97
Palm kernel meal	30.00	30.00	30.00	30.00
Brewed dried grain	25.00	25.00	25.00	25.00
Bone meal	2.50	2.50	2.50	2.50
Vitamin premix	0.25	0.25	0.25	0.25
Sodium chloride	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10
Total (%)	100	100	100	100
Calculated Composition				
Crude protein (%)	20.00	20.00	20.00	20.00
ME (MJ/Kg)	11.26	11.03	10.94	10.85
Ca (%)	0.74	0.74	0.74	0.74
Avail. P (%)	0.31	0.31	0.31	0.31

The experimental design was Completely Randomized Design (CRD) with model:

$Y_{ij} = \mu + T_i + e_{ij}$

Where:

Y_{ij} = Single observation μ = Overall mean. T_i = Treatment effect

e_{ij} = Experimental error.

The pigs were weighed at the start of the experiment and subsequently on a weekly basis at about 7.00 to 8.30 am with a 100 kg capacity hanging scale. Weight gain was determined by subtracting initial live weight from final weight, Feed Conversion Ratio (FCR) as feed intake divided by weight gain, feed intake was determined by subtracting quantity of feed offered from quantity not consumed, protein efficiency ratio as weight gain divided by protein intake and feed cost of weight gain was calculated as FCR multiplied by cost per kg of diet. The experimental feed lasted for four months (120 days).

Data obtained were subjected to analysis of variance (ANOVA), in a Completely Randomized Design (Steel and Torrie, 1980), and differences among treatment means were separated using Duncan's Multiple Range Test (Duncan, 1955).

Results and Discussion

Boiled pigeon pea seed meal (PSM) diets resulted in a significant ($p<0.05$) increase in final live weight of the pigs more than the control (0 % PSM) diet (Table 2). However, there were no significant ($p>0.05$) differences among the pigs fed PSM diets in final live weight, daily weight gain, feed conversion ratio and protein efficiency ratio (PER). At the same time, significant ($p>0.05$) differences did not exist among pigs fed the control and boiled PSM diets in daily feed intake and protein intake. However, 30 % diet (T4) had better protein efficiency ratio (0.85) followed by 20 % (T2), 25 % (T3) and 0 % PSM (T1) (0.82, 0.74 and 0.56) diets respectively and showed a significant difference ($p<0.05$). The better performance of boiled pigeon pea seed meal diets was also reported in the work of Amaefule and Obioha (1998b) and Amaefule and Obioha (2005).

It could be observed (Table 3) that cost/kg weight gain was significantly different ($p<0.05$). The diets with boiled pigeon pea seed meal (PSM) had numerically lower values (₦278.40, 319.19 and 272.04); which suggests that pigeon pea seed meal

diets reduced the cost per weight gain of the pigs, which pigs fed 30 % PSM diet had numerically lowest value (N272.04); this is in consonant with the work of Amaefule and Obioha, (2005). However, boiled pigeon pea seed meal diet also reduced the feed cost especially the cost/kg weight gain by (35.35 %) in T2, (25.88 %) in T3 and (36.83 %) in T4 diets. The boiled pigeon pea seed meal diets gave higher revenue (N9932.00, 8832.00 and 9600.00) which 20 % PSM diet had the highest revenue followed by 30 % PSM diet than the diet with 0 % PSM. The boiled pigeon pea seed meal diets also gave higher gross margin (N5953.63, 4790.06 and 5638.93) which 20 % PSM diet also had the highest margin followed by 30 % PSM diet than the diet with 0 % PSM.

Table 2: Performance of grower pigs fed graded levels of boiled pigeon pea seed meal diets

Parameters (kg)	T1 (0 %)	T2 (20 %)	T3 (25 %)	T4 (30 %)	SEM
Initial live weight	10.15	10.50	9.00	9.00	1.05
Final live weight	19.75^{b}	24.83^{a}	22.08^{ab}	24.20^{a}	0.82
Daily weight gain	0.09^{b}	0.13^{a}	0.12^{a}	0.14^{a}	0.08
Daily feed intake	0.77	0.78	0.79	0.80	0.02
Feed conversion ratio	9.03^{a}	6.11^{b}	7.02^{b}	5.92^{b}	0.61
Daily protein intake	0.15	0.16	0.16	0.16	0.03
Protein efficiency ratio	0.56^{b}	0.82^{a}	0..74^{ab}	0.85^{a}	0.06

^{a,b,} means along the same row with different superscript are significantly different ($p<0.05$).

Table 3: Feed cost of grower pigs fed graded levels of boiled pigeon pea seed meal diets

Parameters (N)	T1 (0 %)	T2 (20 %)	T3 (25 %)	T4 (30 %)	SEM
Cost/Kg of feed	47.69	45.54	45.49	45.29	0.00
Daily feed cost	36.72	35.52	36.09	36.08	1.01
Cost/Kg weight gain	430.64^{a}	278.40^{b}	319.19^{b}	272.04^{b}	27.60
Total revenue	7900.00	9932.00	8832.00	9600.00	1.87
Gross margin	3785.22	5953.63	4790.06	5638.93	4.85

^{a,b,} means along the same row with different superscript are significantly different ($p<0.05$).

Conclusion

It was concluded that boiled pigeon pea seed meal (PSM) could replace soybean and maize in growing pig diets and that the inclusion level could be up to 30 % of the diet and it enhanced the feeding and performance of pigs.

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