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EFFECTS OF GRADED LEVELS OF TOASTED PIGEON (*Cajanus cajan*) SEED MEAL ON THE PERFORMANCE OF GROWER PIGS

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ABSTRACT

A fifty six (56) days feeding trial was conducted to assess the effects of graded levels of toasted pigeon pea seed meal on the performance of grower pigs. Forty crossbred grower pigs with an average body weight of 25.0 kg were used for the experiment. The pigs were randomly allotted to five dietary treatments in a Completely Randomized Design (CRD). Five diets were compounded using toasted pigeon seed meal. Diet 1 was devoid of toasted seed meal while Diets 2, 3, 4 and 5 had 30%, 40%, 50% and 60% inclusion levels of toasted pigeon pea seed meal (TPSM) respectively. Parameters measured included live weight, feed intake, weight gain, feed conversion ratio and economics of production. Result showed that all the parameters considered in the study showed no significant difference ($p>0.05$) across all the treatment groups. . The anti-nutritional factors (oxalate, phytic acid and tannins) composition did not show significant difference ($p>0.05$) across the treatment groups. However, it was observed that feed cost (₦/kg) decreased with the increasing level of pigeon pea seed meal. The value for the cost saving (₦) were; ₦22.07and ₦0.33 for diets T2 and T3 representing 30% and 40% TPSM respectively while diets T4 and T5 representing 50% and 60% TPSM respectively did not exert any positive value. It was therefore concluded that toasted pigeon pea seed could be included up to 60% in the ration of grower pigs successfully without adversely affecting their performance though not economically viable after 40% TPSM inclusion.

Key words: Performance, Grower Pigs, Toasted pigeon pea.

INTRODUCTION

A significant percentage of animal protein supply in Nigeria had in the past depended on ruminants (cattle, sheep and goats) and to a lesser extent on bush game such as antelopes, deer, rabbits and other rodents Vietmeyer, (2005). With a population of over 165 million people and an estimated national population growth rate of 5.7% per annum in Nigeria USAID, (2013), a lot of pressure has been put on these meat sources and as such, other sources of meat had to be sought; as it has become clear that these aforementioned animals alone could no longer sustain the growing demand for animal protein. Thus in short term, Oyawoye (2002) recommended that Nigeria adopts the production of pigs, poultry and rabbits because of their high productive potential and short generational intervals. However, the potential of swine production in alleviating the problem of protein inadequacies in human nutrition in the developing countries of the world is becoming less realizable (Ari, 2012). This has been attributed to high cost, scarcity and insufficient supply of plant and animal protein ingredients such as groundnuts, soya-beans, fishmeal among others (Mahadi, 2002). The prevailing economic crunch has made it become imperative to source for alternative feed ingredients, which should be cheap and yet capable of supplying the nutrients required by the animal for optimum growth and production.

Pigeon pea (*Cajanus cajan*) is rich in nitrogen (21-30% CP) (Amaefule and Onwudike, 2000; Amaefule and Nwagbara, 2004); of relatively low human preference and demand in Nigeria (Amaefule and Obioha, 2001). It has no industrial use in Nigeria at the moment. These attributes have elicited interest among animal nutritionist on the need to explore and exploit further use of the crop as an alternative source of plant protein for ruminants and generally for other livestock species in Nigeria (Amaefule *et al.,* 2006)**.** One of the advantages this crop has over most other legumes used for monogastic feeding is that they are comparatively low in metabolic inhibitors when compared with soya beans (Amaefule *et al*., 2007). Nevertheless, boiling, toasting and soaking are some of the processing methods which had been used (Amaefule 2002) to inactivate these anti-nutritional factors (ANF).

Available data on the utilization of raw and processed pigeon pea seed meal based diets have shown that birds fed processed pigeon pea seed meal diets performed significantly ($P<0.05$) better than those fed raw pigeon pea seed meal. Amaefule *et al*. (2009) fed diets containing raw and boiled pigeon pea to pullets for 56 days. Average daily feed intake and average daily weight gain values for the birds were 32.58 g and 29.26g. FCR values were 5.00 and 4.31 for those fed raw and boiled pigeon pea diets respectively. Corresponding values for feed cost per kg weight gain were 299.87 and 262.81 Naira respectively. In all performance indices mentioned above, the pullets fed diets containing boiled pigeon pea performed significantly ($P<0.05$) better that those fed the raw seeds. Ani and Okeke (2011) conducted two experiments to investigate the effect of roasted pigeon pea Seed Meal (PSM) on growth performance of broiler birds. They 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. This study therefore, is aimed at comparing the performance of grower pigs fed control diet (0% pigeon pea seed) and graded levels of toasted pigeon pea seed meals (30 , 40, 50 and 60%).

MATERIAL AND METHODS

Experimental site

The study was conducted at Otukpo Swine Research Station of National Animal Production Research Institute (NAPRI), Ahamadu Bello University. Otukpo is located in the southern guinea Savanna, on latitude 7-9N and longitude 8-10E and at altitude 490.2m above sea level. The climate is characterized by two well-defined seasons. The raining season normally starts from April to the end of November with an average annual rain fall of 1291.4mm with its peak in August and its lowest value in November. The area has a daily mean maximum and minimum temperature of 28^0C and 19.9^0C respectively. The dry season falls between November and April and its sub-divided into early dry season (harmattan) November to early February and late dry season from March to late April which is very hot and sunny (BNARDA, 2010).

Experimental animals and management

A total of forty crossbred grower pigs, weighing on the average body weight of 25.0 kg obtained from Swine Research Station; National Animal Production Research Institute (NAPRI), out station, Otukpo were used for the experiment.

The pigs were fed the experimental diet twice daily, in the morning (8.00-8.30 am) and afternoon (2.30 3.00 pm) while drinking water was provided ad libitum. They were treated against ecto- and endo-parasites with Ivomectin injection prior to the start of the study. Before the start of the experiment, one-week adjustment period (adaptation period) was observed, using a common diet.

The pigs were individually weighed, and randomly allotted into five dietary treatments of eight grower pigs each. The pigs were further divided into four replicates of two pigs each in a completely randomized design.

Source and Processing of pigeon pea seed

Raw pigeon pea seeds obtained from Ejule market in Kogi State, Nigeria were subjected to toasting in a locally oven-like construction of 1.20m high, 2.00m long and 0.90m wide with a firmly placed frying pan on top using firewood as source of energy. The seeds were stirred constantly in the frying pan to ensure toasting of the seeds were uniform. This toasting was done over the fire until there was a change in the color from white to a dark shade brown with a pleasant aroma emanating. The seeds were poured on the cement floor to cool before being crushed (0.3-0.7mm) as described by (Amaefule and Nwagbara, 2004) and then used as Toasted Pigeon pea seed meal.

Experimental diet

Five (5) isonitrogenous and isocaloric grower diets were formulated to meet the nutrient requirement of grower pigs according to (NRC, 1994**).** Treatment 1(T1) which was the control diet contained 0% toasted pigeon pea seed meal while Treatments (T2,T3,T4 and T5) contained 30, 40, 50 and 60% respectively. The ingredients composition of the experimental diets are shown in Table 1

Laboratory analysis and Statistical analysis

Samples of toasted pigeon pea seeds and experimental diets were analyzed for proximate composition and anti-nutritional factors according to procedures described by (AOAC, 2006) to determine the response of the animals to treatments, all the data collected were subjected to analysis of variance using GraphPad InStat version 3.1 software Inc., 2014. Significant level of difference among treatment means were equally separated using the same statistical tool.

Table 1: **Ingredient composition of grower pigs diets**

Ingredients	Dietary treatments				
	T1	T2	T3	T4	T5
Maize	50.05	33.07	24.52	21.73	16.00
Soybean cake	36.25	23.23	21.78	14.57	10.23
Pigeon pea seed meal	00.00	30.00	40.00	50.00	60.00
Rice offal	10.00	10.00	10.00	10.00	10.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Common salt	0.25	0.25	0.25	0.25	0.25
*Premix	0.25	0.25	0.25	0.25	0.25
Methionine	0.10	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10	0.10
Calculated analysis					
Crude protein (%)	20.01	20.00	19.99	20.03	19.19
M.E. (Kcal/kg)	3143.10	3142.84	3136.33	3121.14	3103.40
Crude fiber (%)	8.71	8.70	8.68	8.68	8.66
Ether extract (%)	9.36	6.72	6.30	4.94	4.15
Ash (%)	3.91	4.01	4.09	4.19	4.27
Calcium (%)	0.12	0.12	0.12	0.12	0.12
Phosphorus (%)	0.55	0.53	0.55	0.55	0.55
Lysine (%)	1.19	1.22	1.24	1.26	1.28
Methionine (%)	0.38	0.34	0.32	0.29	0.26

*Composition per 2.5kg: Vitamin A 10000000IU, Vit.D 2000000IU, Vit E 20000IU, Vit K 2250mg, Thiamine 1750mg, Riboflavin 5000mg, Pyridoxine 2750 mg, Niacin 27500mg, Vit B12 15mg, Pantothenic acid 7500mg, Folic acid 7500mg, Biotin 50mg, Choline chloride 400gm, Antioxidant 125g, Manganese 80g, Zinc 50g, Iron 20g, Copper 5g, Iodine 1.2g Selenium 200mg, Cobalt 200mg

RESULTS AND DISCUSSION

The results of the growth performance indices of the grower pigs presented in Table 2 shows that average daily feed intake (1.67-1.89 kg) and feed conversion ratio (3.16-4.05), daily weight gain (0.47-0.54 kg) and final live weight (56.8-62.7 kg) were not significantly (P>0.05) better with pigs fed the control diet than those fed diets containing pigeon pea. The values of these findings are consistent with that of (Ani and Okeke, 2003) who fed toasted pigeon pea meal to broilers and reported that there was a non–significant dietary treatment effect on the broiler. (Amaefule and Nwaokoro, 2002) also made a similar observation when they fed graded dietary levels of

pigeon pea meal to weaner rabbits. The growth performance observed in this study equally agreed with the findings of Iheukwumere *et al.* (2008) who reported that the DFI, DWG, FCR and FLW of rabbits fed diets containing heat processed pigeon pea meal were not significantly different from the control diet. The DWG of the grower pigs in this study did not indicate significant (P>0.05) difference across the treatments and the values did not follow a particular pattern.

Table 2: Graded Levels of Toasted Pigeon Pea Seed Meal on the Growth Performance of Grower Pigs

	Dietary treatments					
Parameter	T1	T2	T3	T4	T5	SEM
Initial weight (kg)	29.8	30.2	33.1	32.1	30.7	1.37^{NS}
Final weight (kg)	59.9	59.7	62.7	61.9	56.8	0.08^{NS}
Total weight gain (kg)	30.1	29.5	29.6	29.8	26.1	2.42^{NS}
Daily weight gain (kg)	0 .54	0.53	0.53	0.53	0.47	0.03^{NS}
Total feed intake (kg)	95.11	94.7	100.9	104.2	105.8	0.20^{NS}
Daily feed intake (kg)	1.67	1.70	1.80	1.86	1.89	2.81^{NS}
Feed conversion ratio (kg)	3.16	3.31	3.41	3.50	4.05	4.08^{NS}

This observation was made when Amaefule and Nwaokoro (2002) fed graded dietary levels of toasted pigeon pea seed meal to weaner pigs. The findings of this study however, contradicts that of (Etuk *et al*., 2002) who reported that there were significant differences in daily feed intake, daily weight gain, feed conversion ratio and final live weight of broiler finisher birds fed graded levels of pigeon pea meal. The high records of DFI, FCR and the decline in the DWG in the increasing level of toasted pigeon pea seed could be attributed to nutrient unavailability (Udedibie and Carlini, 2000; Esonu *et al*., 2001) due to cumulative anti-nutritive factor in the toasted pigeon pea seed as indicated in Table 3; a confirmation of the findings of (Onu and Okongwu 2006) who reported higher feed intake in broilers on diet containing anti metabolites.

Table 3: Anti-nutrients Factor Composition of Graded Toasted Pigeon Pea Seed meal

	Level of inclusion (%)				
Parameters (mg/100g)	T1 30	T2 40	T3 50	T4 60	SEM
Oxalate	5.75	5.77	5.85	5.90	0.25^{NS}
Phytic acid	11.50	11.55	11.65	11.70	0.22^{NS}
Tannins	0.62	0.65	0.72	0.85	0.36^{NS}

NS= Not significant

The cost implication of feeding graded levels of toasted pigeon pea seed meal (PSM) diets to grower pigs is presented in Table 4. The result showed that there were significant differences (P<0.05) among treatments in feed cost per kg, cost of total feed intake and cost of feed per kg weight gain. It was observed that feed cost (₦/kg) decreased with the increasing level of pigeon pea seed meal. It also agreed with results of (Augustine *et al.,* 2010), on economic evaluation of broiler chickens feed graded levels of processed *Cassia obtusifolia* seed meal. Feed cost saving was similar in trend to the result of (Augustine *et al.,* 2010). However, cost of total feed intake and feed cost per kg weight gain (₦/kg/gain) did not follow the same trend. This could be because of the differences observed in the total feed intake and the total weight gain of the pigs. This finding had contrary result with the findings of (Yisa *et al.,* 2009) who in similar experiment on cockerel recorded increasing cost with increasing levels of boiled pigeon pea. The cost of producing a kilogram gain of the experimental animal was cheaper using diet T2 (30 % TPSM) followed by diet T3 (40% TPSM). Diets T4 and T5 (50 and 60% TPSM) respectively, could not add value to the control diet.

Table 4: Economics of Production of Grower Pigs Fed Graded Levels of Toasted Pigeon Pea Seeds Meal

	Levels of Toasted Pigeon Pea Seed Meal (%)					SEM
	0	30	40	50	60	
Parameter	T1	T2	T3	T4	T5	
Total feed intake (kg)	95.11	94.7	100.9	104.2	105.8	0.20^{NS}
Feed cost (₦/kg)	102.7^{a}	94.1^{b}	95.1^{c}	96.1^{d}	97.1^{e}	0.14*
Cost of total feed intake (₦)	97673^{c}	8911.27^{e}	9595.59^{d}	10013.6^{b}	10273.18^{a}	0.25*
Total weight gain (kg)	30.1	29.5	29.6	29.8	26.1	2.42^{NS}
Cost/kg weight gain (₦)	324.51^{c}	302.08^{e}	324.18^{d}	336.03^{b}	393.61^{a}	0.14*
Feed cost saving (₦)		22.07	0.33	-11.52	-69.10	

^{a,b,c,d,e} Means within the same row having different superscripts are significantly different (P<0.05).
Calculated based on market price of the ingredients (N/kg) at the time of the experiment (maize=55.0; soya bean seed=125.0; pigeon pea seed=95.0; rice offal=2.0; bone=100.0; salt=30; premix=550.0; methionine=1600.0; lysine=80

CONCLUSION

There were no significant difference (P>0.05) among the grower pigs fed the control and diets containing different graded levels of toasted pigeon pea seed diet in their growth performance. The results indicated that the processing by toasting made the protein in pigeon pea seed more available to the grower pigs and also removed some of the antinutritional factors in raw pigeon pea seed. The cumulative level of anti-nutritional factor in the graded levels of TPSM was not significant enough to cause deleterious effect on the grower pigs. It is therefore concluded that the toasting processing techniques before its inclusion in grower pigs diets, enhances the protein quality and status of pigeon pea seed as a component of grower pigs diet and that growing pigs could therefore be fed up to 60% inclusion levels of toasted pigeon pea seed meal. With respect to economics of production, the results here suggest that toasted pigeon pea seed meal could be included in grower pig diets by up to 40% without any significant appreciation in the cost of producing the pigs.

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