

Effect of cooked pigeon pea seed meal on the performance, dressed and organ weight characteristics of broilers

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Abstract

Seeds of pigeon pea (*Cajanus cajan*) grown in Enugu State in the South East Agricultural zone of Nigeria were studied to determine its effect on performance, dressed weight and organ weight characteristics of broilers. The dry, brown coat coloured pigeon pea seeds were cooked in boiling water for 60 minutes, sun-dried, made into a meal and stored in feed bags. The cooked pigeon pea seed meal (CPSM) at 0, 20, 30, 40, and 50% dietary levels replaced 0, 40, 60, 80 and 100% of soybean meal and 0, 20, 30, 40 and 50% of maize, respectively in formulated broiler starter diets. CPSM also replaced 0, 50, 75 and 100% of soybean meal and 0, 18.18, 27.27, 36.36 and 54.54% of maize, respectively in formulated broiler finisher diets. The formulated broiler starter and finisher diets were fed to 7 - day old hubbard broilers in two successive regimes of 28 days each, for the starter and finisher phases respectively. At 63 days of age, 3 broilers of comparable live weights per replicate were selected, starved of feed for 12 hours, slaughtered and eviscerated to determine the dressed weights and internal organ weights. Broilers fed 0% CPSM diet recorded significantly ($P < 0.05$) higher live weight gains than those on CPSM diets except broilers fed 20% CPSM. Feed intake was significantly ($P < 0.05$) higher among broilers fed 50% CPSM diet and significantly ($P < 0.05$) lower among birds on the control (0% CPSM) diet. Results obtained also indicated a significant ($P < 0.05$) difference in dressed weight between birds fed CPSM diets and the control diet (0% CPSM). Birds fed 20% CPSM diet recorded the highest dressed weight. Liver weight decreased progressively with increasing dietary inclusion level of CPSM with birds fed 50% CPSM diet recording significantly ($P < 0.05$) lower weights. Weight of gizzard was also significantly ($P < 0.05$) lower for birds fed 50% CPSM diet. Heart and spleen weights followed a similar pattern with birds fed 20% CPSM diet recording significantly ($P < 0.05$) higher weights for heart and lower weight for spleen respectively. It would appear that dietary CPSM tend to improve the dressed weight of broilers.

Keywords: Cooked, pigeon pea seed meal, performance, dressed weight, organs, broilers

Introduction

Pigeon pea [*Cajanus cajan* (L) Millsp], a tropical legume seed has been extensively mentioned as a potentially good feedstuff for poultry (Udedibie and Igwe, 1989; Tangweewipaat and Elliot, 1989; Holness, 1991; Pezzato *et al*, 1997; Amaefule and Obioha, 1998; Etuk and Udedibie,

2002a, Etuk and Udedibie, 2002b). However, as with most tropical legumes, pigeon peas contain antinutritional factors, which is known to reduce its nutritive value in poultry feed. Various methods have been elucidated in studies to either reduce or completely eliminate these antinutritional factors in pigeon pea seed meal. Cooking of pigeon pea, a

heat treatment procedure, tend to reduce the antinutritional factors (Apata and Ologhobo, 1997) and give an improved performance in terms of weight gain of broilers (Amaefule and Obioha, 1998; Amaefule and Onwudike, 2000).

Performance parameters such as weight gain, feed intake and feed conversion ratio (FCR) vary depending on the level of inclusion of pigeon pea seed meal in the diet even when subjected to heat treatment (Amaefule and Obioha, 1998, Etuk and Udedibie, 2002a). Similarly, dressed weight and internal organ weight characteristics are veritable indicators of the level of reduction or otherwise of antinutritional factors in processed pigeon pea seed meal included at varying levels in poultry diet (Bamgbose *et al*, 2004). Dressed weight is an indication of the value of meat in real terms that could be obtained from broilers. The internal organs have a very significant role in body metabolic activities (Ogunlayi, 1999), their characteristics may therefore indicate the level of antinutritional factors.

According to Madhusudhan *et al* (1986), presence of antinutritional factors has been associated with enlargement of organs like liver and pancreas. Al-Dabagh and Abdulla (1963) also reported that factors like age, diet and body weight influence affect organ weight. This study was therefore aimed at determining the effect of cooked pigeon pea seed meal diet on performance, dressed weight and organ weight characteristics of broilers.

Materials and Method

Brown coat coloured pigeon pea seeds sourced from Nsukka area of Enugu state in the south-east agricultural zone of Nigeria were used for this study. The pigeon pea seeds were cooked in

boiling water for 60minutes. This was achieved by immersing pigeon pea seeds in four times its volume of water in a drum already set on open burning firewood. The seeds were considered properly cooked after boiling for 60minutes. The seeds were then drained out of the water sun-dried to about 90% dry matter level, milled and stored in bags labeled CPSM. Proximate composition of CPSM was determined as outlined by (AOAC, 1990). Broiler starter diets were formulated to contain 0, 20, 30, 40 and 50% CPSM each replacing 0, 40, 60, 80 and 100% of soybean meal and 0, 20, 30, 40 and 50% of maize, respectively (Table 2). Formulated broiler finisher diets also contained 0, 20, 30, 40 and 50% CPSM each replacing 0, 50, 75, and 100% of soybean meal and 0, 18.18, 27.27, 36.36 and 54.54% of maize, respectively (Table 3). Each broiler starter diet was fed to 4 replicates of 6, 7 - day-old hubbard broilers for 28 days. The broiler finisher diets were fed to the same replicates and number of birds for the subsequent 28days in a completely randomized design experiment. The initial live weights, final weights and feed intake of the broilers were recorded and the values used to determine the weight gains, feed conversion ratio and feed cost per kg dressed weight. At 63 days of age, 3 broilers of comparable live weight per replicate were selected, starved of feed for 12 hours, slaughtered, defeathered to determine the dressed weight and eviscerated to determine the internal organ weight (liver, gizzard, heart and spleen). Dressed weights were measured using the Five goat^R model 5kg scale, while the internal organ weight were determined using the Ohaus Marca (US Pat. 2729439) triple beam balance. Data obtained were subjected to analysis of variance (ANOVA). Where significant effects were detected, the means were separated using the Duncan's New Multiple Range Test (DNMRT) as outlined by Obi (1990).

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Table 1: Proximate composition of cooked pigeon pea seed meal

Nutrients	Proximate composition (%DM)
Dry matter	91.31
Moisture	8.67
Crude protein	19.46
Ether extract	7.98
Crude fibre	6.50
Ash	2.35
NFE	55.02

Table 2: Composition of experimental broiler starter diet (g kg⁻¹)

Feedstuff*	CPSM Inclusion level				
	0.0%	20.0%	30.0%	40.0%	50.0%
Maize	500.0	400.0	350.0	300.0	250.0
Soybean meal	250.0	150.0	100.0	50.0	0.0
CPSM	0.0	200.0	300.0	400.0	500.0
Calculated					
Composition (g kg⁻¹)					
Crude protein	234.8	231.8	230.3	228.8	227.7
Ether extract	36.5	31.5	28.9	26.3	23.8
Crude fibre	38.8	39.1	39.2	39.3	39.5
Total calcium	13.2	13.2	13.2	13.2	13.2
Total phosphorus	8.0	7.9	7.8	7.8	7.7
Lysine	14.5	16.8	18.1	19.3	20.5
Methionine	4.0	3.5	3.3	3.0	2.8
ME (MJ kg ⁻¹)	12.03	12.06	12.08	12.09	12.10

*Each diet contained the following (g kg⁻¹): Wheat bran – 80.0, Palm kernel cake – 40.0, Fish meal – 40.0, Blood meal – 50.0, Bone meal – 30.0, Common salt – 5.0 and Vitamin/Mineral Premix** – 5.0

CPSM = Cooked pigeon pea seed meal

** To provide the following per kg of feed: vitamin A, 10,000 iu; vitamin D₃, 2000 iu; vitamin E, 5 iu; vitamin K, 2mg; riboflavin, 4.2mg; vitamin B₁₂, 0.01mg; pantothenic acid, 5mg; nicotinic acid, 20mg; folic acid, 0.5mg; choline, 3mg; Mg, 56mg; Fe, 20mg; Cu, 1.0mg; Zn, 5.0mg; Co, 1.25mg; Iodine, 0.8mg.

Results

The proximate composition of cooked pigeon pea seed meal (CPSM) shows a crude protein content of 19.46% and 55.02% NFE (Table 1). Other results as shown in Table 4 indicated a depressed live weight gain with increasing level of CPSM in the diet. The birds fed the control diet (0%CPSM) and 20% CPSM diet recorded significantly (P<0.05) higher weight gains than birds fed other treatment diets. Feed intake was

significantly (P<0.05) higher among broilers fed 50%CPSM diet and significantly (P<0.05) lower among birds on the control (0%CPSM) diet. Feed conversion ratio followed the same trend as weight gains with birds fed control diet recording significantly (P<0.05) lower FCR than other treatment groups. It was observed that feed cost per kg weight gain increased progressively with increasing level of CPSM in the diet.

Table 3: *Composition of experimental broiler finisher diet (g kg⁻¹)*

Feedstuff*	CPSM Inclusion level				
	0.0%	20.0%	30.0%	40.0%	50.0%
Maize	550.0	450.0	400.0	350.0	250.0
Soybean meal	200.0	100.0	50.0	0.0	0.0
CPSM	0.0	200.0	300.0	400.0	500.0
Calculated chemical composition (g kg⁻¹)					
Crude protein	201.5	198.5	197.0	195.5	210.5
Ether extracts	37.3	32.2	29.7	27.1	24.3
Crude fibre	39.1	39.4	39.5	39.7	42.1
Calcium	13.2	12.5	12.5	12.5	12.6
Phosphorus	6.9	6.8	6.7	6.6	6.8
Lysine	11.6	14.0	15.2	16.4	18.9
Methionine	3.4	3.0	2.8	2.8	2.8
ME (MJ kg ⁻¹)	12.10	12.13	12.14	12.16	12.02

*Each diet contained the following (g kg⁻¹): Wheat offal – 100.0, Palm kernel cake – 50.0, Fish meal – 30.0, Blood meal – 30.0, Bone meal – 30, Salt – 5.0 and Vitamin/Mineral Premix** – 5.0. CPSM = Cooked pigeon pea seed meal.
 ** To provide the following per kg of feed: vitamin A, 10,000 iu; vitamin D₃, 2000 iu; vitamin E, 5 iu; vitamin K, 2mg; riboflavin, 4.2mg; vitamin B₁₂, 0.01mg; pantothenic acid, 5mg; nicotinic acid, 20mg; folic acid, 0.5mg; choline, 3mg; Mg, 56mg; Fe, 20mg; Cu, 1.0mg; Zn, 5.0mg; Co, 1.25mg; Iodine, 0.8mg.

The dressed weights and internal organ weights of the broilers are shown in Table 5. Broilers fed 20% CPSM diet recorded the highest dressed weight and dressed weight decreased thereafter non-significantly ($P > 0.05$) with increasing level of CPSM in the diet. Birds fed the control diet recorded significantly ($P < 0.05$) lower dressed weight than those on CPSM treatment groups.

Liver weights on the other hand, indicated a progressive reduction with increasing level of CPSM in the diets. Birds fed 40% and 50% CPSM diets had significantly ($P < 0.05$) lower liver weights than birds fed 0%, 20% and 30% CPSM diets. Weights of gizzard did not follow

any discernable pattern but birds fed 50% CPSM recorded significantly ($P < 0.05$) higher gizzard weights while birds on 30% CPSM recorded the lowest weights.

Weights of the heart were the same for all treatment groups except for birds on 20% CPSM which recorded significantly ($P < 0.05$) higher weight. Also spleen weights did not show any significant ($P < 0.05$) difference for all the treatment groups except for birds on 20% CPSM diet where there was a depression in weight. Feed cost per kg weight gain increased with increasing level of CPSM in diet signifying a high FCR. However, feed cost per kg dressed weight did not follow the same pattern

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Table 4: Performance of broilers fed varying levels of cooked pigeon pea seed meal diet.

Treatments	Pre-treatment weights (g)	Post treatment weight (g)	Weight gain (g)	Feed Intake (g)	FCR (g feed/g gain)	Feed cost (₦/kg weight gain)	Feed cost (₦/kg dressed weight)
0% CPSM	115.9 ^a	2175.0 ^a	2059.1 ^a	5353.6 ^a	2.6 ^a	67.13 ^a	98.89 ^a
20% CPSM	116.0 ^a	1950.0 ^b	1834.0 ^{ab}	6235.6 ^b	3.4 ^b	85.68 ^b	98.03 ^a
30% CPSM	115.5 ^b	1890.0 ^b	1774.5 ^b	6210.7 ^b	3.5 ^b	87.08 ^b	94.04 ^b
40% CPSM	115.0 ^c	1852.0 ^b	1737.0 ^b	6253.2 ^b	3.6 ^b	88.45 ^b	95.08 ^{bc}
50% CPSM	115.0 ^c	1860.0 ^b	1745.0 ^b	6631.0 ^c	3.8 ^b	91.80 ^b	96.88 ^{ac}
SEM	0.063	59.92	59.77	43.22	0.20	4.34	0.90

CPSM = Cooked pigeon pea seed meal. FCR = Feed conversion ratio ₦ = Naira

Table 5: Dressed weight and internal organs weight of broilers (g kg⁻¹ live weight)

Treatments	Dressed weight	Liver	Gizzard	Heart	Spleen
0% CPSM	877.1 ^b	17.8 ^a	16.3 ^{ac}	3.8 ^a	1.0 ^a
20% CPSM	908.7 ^a	17.7 ^a	16.6 ^{ac}	4.3 ^b	0.8 ^b
30% CPSM	906.4 ^a	17.6 ^a	18.0 ^b	3.8 ^a	1.1 ^a
40% CPSM	904.6 ^a	16.8 ^{ab}	17.9 ^{ab}	3.8 ^a	1.1 ^a
50% CPSM	903.6 ^a	15.8 ^b	15.0 ^c	3.8 ^a	1.0 ^a
SEM	5.77	0.37	0.55	0.10	0.05

SEM = Standard error of mean

^{abc} means within a column with different superscripts are significantly different (P<0.05)

Discussion

The pattern of weight gain indicate a higher utilization of the control diet than diets containing cooked pigeon pea seed meal by broilers. It would appear that the decreasing crude protein level of the CPSM diets contributed to the lower weight gains. Although 50% CPSM diet had the highest crude protein value, utilization appear to be low which resulted in low weight gains. Also, pigeon pea I known to be deficient in methionine which may have resulted in amino acid imbalance thus affecting protein utilization by the broilers (Biobaku and Oladipupo, 2002; Etuk *et al*, 2003).

The dressed weights, which showed increases among broilers fed dietary CPSM may have resulted from the increasing level of metabolizable energy in the broiler starter and finisher diets. Iyayi and Yahaya, (1999) reported that reduced metabolisable energy content of feed tends to have the effect of reducing the weight of carcass and intestine, gizzard and liver of birds. The decreased metabolisable energy value recorded in broiler finisher diet containing 30% CPSM did not however result in a reduction in dressed weight probably because of the increased crude protein level. These results also indicate that cooking for 60minutes sufficiently reduced the antinutritional factors in brown coat coloured

pigeon pea seed meal because there was no corresponding significant decline in carcass weight with increasing level of cooked pigeon pea seed meal in the diets. Emenalom *et al* (2004) had earlier reported that reduced carcass weight could be attributed to antinutritional factors, which increased with level of inclusion.

The liver weight decreased progressively with increasing inclusion level of CPSM in the diets. It is therefore probable that cooking for 60 minutes did reduce substantially the antinutritional factors in pigeon pea (Apata and Ologhobo, 1997). According to Alimot and Nitsan, (1961), Madhusudhan *et al* (1986) and Aderemi (2003) presence of antinutritional factors have been associated with the enlargement of organs like liver and pancreas because of their higher detoxification activity. The higher crude fibre content of the diets containing CPSM did not seem to affect the internal organ weight of the broilers. This is probably because the crude fibre level is within tolerable limit. Higher crude fibre content according to Aderemi (2003) leads to increased weights of visceral organs of chicks to the detriment of edible carcass. Shurlock and Forbes (1981) reported that there is a relationship between live weight, dressed weight, carcass parts and organ weights. This study however indicates an inverse relationship between liver weights and dressed weights of broilers. This contrasts the report of Iyayi and Yahaya (1999) that carcass and organ weights followed the same trend as dressed weight in broilers.

References

Aderemi, F. A. 2003. Effect of enzyme supplemented cassava root sievate (CRS) in cassava-based diet on some visceral organs of pullet chicks. *Proc. 8th Ann. Conf. Anim. Sci. Assoc. Nig (ASAN), September 16th – 18th, Federal University of Technology, Minna, Nigeria.*

- Al-Dabagh, M. A. and Abdulla, M. 1963.** Correction of sizes and weights of livers and spleen to the ages and weight of normal chicks with a note on histology of these organs. *Vet. Rec.*, 75: 397 – 400.
- Alimot, E. and Nitsan, Z. 1961.** The influence of soybean and anti-trypsin inhibitors on the intestinal proteolin of the chick. *J. Nutr.*, 73: 71 – 77.
- Amaefule, K. U. and Onwudike, O. C. 2000.** Evaluation of processing method for pigeon pea seed (*Cajanus cajan*) as protein source for broiler starters. *J. Sust. Agric. Environ.* 2(1): 134 –138.
- Amaefule, K. U. and Obioha, F. C. 1998.** Substitution of pigeon pea seed (*Cajanus cajan*) for groundnut cake (GNC) and maize in broiler finisher ration. *Nig. J. Anim. Prod.* 25(1): 9 – 12.
- AOAC 1990.** Official method of analysis. Association of official analytical chemists. 13th edition, Washington DC.
- Apata, D. F. and Ologhobo, A. D. 1997.** Trypsin inhibitor and other antinutritional factors in tropical legumes seeds *Trop. Sci.* 37: 52 – 59.
- Bamgbose, A. M., Abioye, S., Oboh, S. O., Aruna, M. B., Isah, O. A., Obasohan, S. O., Omoikhoje, J. A. and Imasuen, J. A. 2004.** Response of broilers to dietary levels of processed pigeon pea meal. *Proc. 9th Ann. Conf. Anim. Sci. Assoc. Nig. (ASAN), Sept. 13th –16th. Ebonyi State University, Abakiliki, Nigeria* pp. 23 – 25.
- Biobaku, W. O. and Oladipupo, O. O. 2002.** Determination of optimum methionine and lysine requirements for growing rabbits.

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- Proc. 7th Ann. Conf. Anim. Sci. Assoc. Nig. (ASAN). Spet. 15th – 19th, University of Agriculture, Abeokuta . pp. 101 –102.*
- Emenalom, O. O.; Okoli, I. C. and Udedibie, A. B. I. 2004.** Observations on the patho physiology of weaner pigs fed raw and pre-heated Nigerian *Mucuna pruriens* (Velvet bean) seed. *Pakistan J. Nutrition.* 3(2): 112 – 117.
- Etuk, E. B. and Udedibie, A. B. I. 2002a.** Replacement value of cooked pigeon pea (*Cajanus cajan*) seed meal for soybean meal and maize in broiler finisher diet. *J. Sust. Trop. Agric. Res.*, 3: 93 – 96.
- Etuk, E. B. and Udedibie, A. B. I. 2002b.** Substitution value of toasted pigeon pea (*Cajanus cajan*) seed meal for soybean meal and maize in broiler starter diet. *Int. J. Rur. Dev.*, 3: 92 – 97.
- Etuk, E. B., Esonu, B. O. and Njoku, C. 2003.** Effect of methionine supplementation on the performance of finisher broilers fed pigeon pea seed meal based diet. *Proc. 28th Ann. Conf. Nig. Soc. Anim. Prod. (NSAP) March 6th – 20th, IAR&T, Ibadan., Pp. 258 –260.*
- Holness, D. H. 1991.** *Tropical Agriculturalist – Pigs.* CTA/Macmillian Educational Ltd. London. p. 68.
- Iyayi, E. A. and Yahaya, B. 1999.** Performance of broilers maintained on diets supplemented with a commercial polysaccharide enzyme in the humid tropics. *Trop. Anim. Prod. Invest.* 2: 125 – 130.
- Madhusudhan, K. T., Ranesh, H. P., Ogawa, T., Sasaoka, K. and Singh, N. 1986.** Detoxification of commercial linseed meal for use in broiler ration. *Poult. Sci.*, 65: 164 –171.
- Obi, I. U. 1990.** *Statistical Methods of Detecting Differences Between Treatment Means.* Snaap Press, Enugu, Nigeria.
- Ogunlayi, O. S. 1999.** Physico-chemical and biochemical properties of cereal and legume fibre products treated with enzyme. Ph.D. thesis University of Ibadan, Ibadan, Nigeria.
- Pezzato, A. C., Silveir, G. A., Pezzato, L. E., Ben-Arrigom-M de and de Beni Arrisgoni – M. 1997.** Substitution of soybean with pigeon pea meal in broiler feed. *Pesquisa - Agropecuaria, Brasileria.*, 32(2): 123 – 133.
- Shurlock, T. G. H. and Forbes, J. M. 1981.** Factors affecting feed intake in the domestic chicken: The effect of infusions of nutritive and non-nutritive substances into the crop and duodenum. *Brit. Poult. Sci.*, 22: 23 – 331.
- Tangweewipat, S. and Elliot, R. 1989.** Nutritional value of pigeon pea (*Cajanus cajan*) seed meal in poultry diet. *Anim. Feed Sci. and Tech.*, 25: 123 – 135.
- Udedibie, A. B. I. and Igwe, F. O. 1989.** Dry matter yield and chemical composition of pigeon pea (*Cajanus cajan*) leaf meal and the nutritive value of pigeon pea leaf meal and grain meal for laying hens. *Anim. Feed Sci. and Tech.*, 24: 111 – 119.

(Received 14 March 2005; Accepted 02 August 2005)