EFFECT OF DIETS CONTAINING RAW AND PROCESSED PIGEON PEA SEED MEAL ON EGG QUALITY CHARACTERISTICS OF LAYING QUAILS (*Coturnix coturnix Japonica*)

A. R. AKINTUNDE,[1*] J. J. OMAGE[2], G. S. BAWA[2], P. A. ONIMISI[2] AND A. O. ATANDA[2]
[1]*Department of Animal Science, Taraba State University, Jalingo, Taraba State*
[2]*Department of Animal Science, Ahmadu Bello University, Zaria.*
**Correspondence: fola_akintunde@yahoo.com, 07036895725*

ABSTRACT
Three hundred and sixty (360), six week old Japanese quail hens *(Coturnix coturnix japonica)* were used to evaluate the effect of processed pigeon pea (*Cajanus cajan)* seed meal (PPSM) on egg quality characteristics in a randomized design feeding trial. The processing methods are soaking (for 24, 48 and 72 hours), fermentation for 72 hours, boiling for 60 minutes and roasting for 30 minutes. The birds were divided into eight groups of 45 each replicated three times. The birds were raised in cages measuring 75cm × 75cm × 60cm. Eight experimental diets were formulated containing processed PPSM at 30 % of diet representing T1 (Control), T2 (raw PPSM), T3 (Soaked PPSM for 24 hours), T4 (Soaked PPSM for 48 hours), T5 (Soaked PPSM for 72 hours), T6 (Soaked PPSM for 24 hours and Fermented for 72 hours), T7 (Boiling for 60 minutes) and T8 (Roasted PPSM for 30 minutes) respectively. The diets were fed to the birds from 7 to 26 weeks of age. Feed and water were provided *ad libitum*. The results showed that processed PPSM had no significant (P>0.05) effect on egg weight, egg height, egg diameter, egg shape index, egg shell thickness as well as albumen height, albumen diameter, albumen weight, yolk diameter, yolk weight, yolk index and haugh unit across the dietary treatments. It was concluded that processed PPSM had no significant (P>0.05) effect on the egg quality characteristics of laying quails.
Keywords: Pigeon pea, processing, Quail hens, egg quality.

INTRODUCTION
The problem of feed shortage arising from sky rocketing prices of conventional protein and energy feed ingredients (e.g. groundnut cake, soybean, maize, sorghum etc.) has negatively affected animal protein supply. This however has created a wide gap between the demand and supply of animal protein in Nigeria and many underdeveloped countries of the world. Thus, average animal protein intake of persons in most of these countries is far below the recommendations (Oyawoye, 2002).

Pigeon pea (*Cajanus cajan*) is one of the feedstuff that could serve as a useful alternative (non-conventional protein sources) to soybean meal and groundnut cake in the diets of poultry birds to improve and sustain livestock production. It is one of the widely grown and moderately yielding legume (300 – 3000 kg/ ha legume dry seeds) in native farms and yield 5000 – 7000 kg / ha under improved cultivation for over 2 -3 years period (Phillip, 1997). It has a crude protein values of 20.6 – 27.7 % and is desirable due to its high nutrient profile (Apata and Ologhobo, 1993). However, the presence of anti nutritional factors (e.g trypsin inhibitors, tannins, trypsin, haemagluttinins etc) and their effects limit its use (Amaefule and Nwagbara, 2004). Most of these toxins are reduced to tolerable levels through various processing methods such as soaking, fermentation, cooking, roasting, dehulling etc (Kaankuka *et al.*, 2000).

Japanese quail (*Coturnix coturnix japonica*) was introduced to Nigeria in 1992 in order to bridge the gap between the demand and supply of animal protein in Nigeria and also to expand the poultry subsector through meat and egg production (Ani, 2009). Quails are fast growing poultry species and are very economical to maintain as they require less floor space (Haruna *et al.*, 1997). They are small sized, early maturing, hardy, prolific and have less feed requirement of 20-25 g per day. They come to sexual maturity and egg production early between 5-6 weeks of age and attain market weight of 150-180 g at almost the same age. The meat is of high quality protein and has low cholesterol. The aim of this study was to investigate the effect of processed PPSM on the

egg quality characteristics of Japanese quail hens.

MATERIALS AND METHODS

This study was conducted at the Poultry Unit of the Department of Animal Science Teaching and Research Farm, Ahmadu Bello University – Samaru – Zaria, Kaduna State.

The Pigeon pea seeds used for this study were purchased from Samaru Market in Sabon Gari, Kaduna State. A total of three hundred and sixty (360) six – week old female quails purchased from National Veterinary Research Institute (NVRI) Vom, Jos were used. Forty – five (45) birds were assigned to eight dietary treatments which contained 22 % crude protein. T1 served as the control (0 % PPSM) while other diets contained 30 % inclusion of pigeon pea seed meal designated as T2, T3, T4, T5, T6, T7 and T8 with 15 chicks per replicate in a completely randomized design. The birds were raised in cages measuring 75cm × 75cm × 60cm. Feed and water were provided *ad libitum,* necessary drugs were administered. The experiment lasted for 20 weeks. The experimental diets are presented in Table 1. Eggs were weighed using an electronic top loading scale. Egg length and diameter (External egg quality characteristics) were measured with venier caliper and egg shape index was calculated as egg diameter divided by the length. After cutting the eggs open to obtain yolk and albumen, the egg shells were carefully washed with water to remove adhering albumen, dried at room temperature and weighed to obtain egg shell weight. Yolk diameter, yolk height and albumen height (Internal characteristics) were determined using a venier caliper. The Haugh unit was calculated using the formula proposed by Haugh (1937).

$$HU = 100 \log_{10} (h - 1.7W^{0.37} + 7.6),$$

where HU = Haugh Unit, H = Observed height of the albumen (mm), W = Weight of egg (g).

Egg shell thickness was measured with a micrometer screw gauge.

Statistical analysis

All data obtained were subjected to analysis of variance using the general linear model procedure of Statistical Analytic System (SAS, 2008). Significant differences among treatment means were separated using Tukey model.

RESULTS AND DISCUSSION

The result of this study is presented in Table 2. This showed that all the external egg quality parameters evaluated such as egg weight, egg height, egg diameter, egg shape index and egg shell thickness of birds showed no significant ($P>0.05$) differences across the dietary treatments.

The internal egg quality parameters evaluated such as albumen height, albumen diameter, albumen weight, yolk height, yolk diameter, yolk weight, yolk index and Haugh unit measured also showed no significant ($P>0.05$) differences across the dietary treatments. The albumen quality across the dietary treatments was indicated by the Haugh unit values.The non-significant difference observed in the external egg quality characteristics in terms of egg weight, egg height and egg diameter and internal egg quality parameters such as yolk, albumen and Haugh unit of birds in this study could be attributed to balanced nutrient utilization across the treatments and also showed that inclusion of PPSM had no negative effect on the external and internal egg quality characteristics of the quails. This result was in agreement with the findings of Abeke (2005) who reported that inclusion of lablab seeds in the diets of laying hens had no significant ($P>0.05$) effect on the yolk index, Haugh unit, shell index, shell thickness and shell percentage.

CONCLUSION

From the result of this study, it was concluded that inclusion of raw and processed PPSM in the diets of laying quails had no significant effect on their egg quality characteristics.

REFERENCES

Abeke, F. O. (2005). Evaluation of the nutritive value of Lablab purpureus beans in replacement for groundnut cake in poultry diets (Doctoral dissertation, Ph. D Thesis, Ahmadu Bello University, Zaria, Nigeria).

Amaefule, K.U. and Obioha, F.C. (2001). Performance and nutrient utilization of broiler starters fed diets containing raw boiled or dehulled pigeon pea (Cajanus cajan) seeds. Nigerian Journal of Animal Production 28 (1): 31-39.

Amaefule, K. U. and Nwagbara, N. N. (2004). The effect of processing on nutrient

utilization of Pigeon pea (Cajanus cajan) seed meal and Pigeon pea seed meal based diets by Pullets. International Journal of Poultry Science3(8): 543-546.

Ani, A.O. (2009). Effects of graded level of raw bambara-nut (Voandazia subteranian L) waste on nutrient Intake, digestibility and utilization of rabbits. Nigerian Journal of Animal Production 36 (2): 237 – 245.

Apata, D.F. and Ologhobo, A.D. (1993). Biochemical evaluation of some Nigerian Legume Seeds. Food Chemistry 49: 33 - 38.

Haruna, E.S., Musa, U., Okewole, P.A., Shemaki, D., Lombin, L.H., Molokwu, J.U., Edache, J.A. and Karsin, P.D. (1997). Protein requirement of quail chicks in Plateau State, Nigeria. Nigerian Veterinary Journal 18: 108-113.

Kaankuka, F.G., Balogun, T.F., Bawa, G.S. and Dim, S. (2000). Effect of cooking soybean on DM digestibility and Energy in pigs. Indian Journal of Animal Science 70 (7): 740-743.

Oyawoye, E. O. (2002). Eradication of Animal Protein Malnutrition in Nigeria through the Production and Consumption of Micro-Livestock: A task that must be done. 28th Inaugural Lecture. Abubakar Tafawa Balewa University, Bauchi.

Phillips, D.E. (1997). Protein Quality in seeds meal of Phaseolus vulgaris and heat stable factors affecting the utilization of protein. Journal of Food Science and Agriculture 32: 423 - 432.

Purdue University, (2006). Centre for crops and plant products. Cajanus Cajan (L.) Millsp.

SAS (2008). SAS/ STAT User's Guide. Version 9.2 for windows. SAS Institute Inc; SAS Campus Drive Carry, North Califonia, U.S.A.

Table 1: Composition of Quail Layer Diets Containing Differently Processed Pigeon Pea Seed Meal (7-26 weeks)

	Treatments							
Ingredients	**1 Control**	**2 Raw PPSM**	**3 Soaked PPSM (24hrs)**	**4 Soaked PPSM (48 hrs)**	**5 Soaked PPSM 72hrs**	**6 Soaked+ Fermented PPSM**	**7 Boiled PPSM (60mins)**	**8 Roasted PPSM (30mins)**
Maize	51.70	34.37	34.37	34.37	34.37	34.37	34.37	34.37
SBM	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
PPSM	0.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
GNC	30.40	17.73	17.73	17.73	17.73	17.73	17.73	17.73
Bone	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
Limestone	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
Common Salt	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Methionine	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Lysine	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Vitamin Premix*	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100	100	100	100
Determined Analysis								
ME (Kcals/kg)	2981	2989	2968	2977	2981	2976	2985	2982
Crude protein (%)	21.44	21.75	22.13	22.06	22.56	22.88	22.63	22.61
Crude Fibre (%)	6.57	6.67	7.41	6.72	7.32	7.32	7.34	7.96
Ether Extract (%)	5.26	5.45	4.92	4.88	4.69	4.41	4.35	4.22
Calculated Analysis								
Calcium (%)	2.70	2.71	2.71	2.71	2.71	2.71	2.71	2.71
Phosphorus (%)	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71
Lysine (%)	1.10	1.28	1.28	1.28	1.28	1.28	1.28	1.28
Methionine (%)	0.66	0.68	0.68	0.68	0.68	0.68	0.68	0.68
Cysteine (%)	0.36	0.33	0.33	0.33	0.33	0.33	0.33	0.33
Feed cost/kg (₦)	75.18	76.41	76.41	76.41	76.41	76.41	83.08	83.08

*Biomix layer premix provided per kg of diet: Vit A. 12,000 I.U; Vit D_3 1,500 I.U; Vit E 10,000mg; Vit K_3 1,000mg; Vit. B_1 1500mg; Vit. B_2 4,500mg; Niacin 15,000mg; Pantothenic acid 4,500mg; Folic acid 1,000mg; Vit. B_6 3,000mg, Vit. B_{12} 15.00mg; Vit.C 45,000mg; Biotin 100mg; Choline chloride 300,000mg; Cobalt 20,000mg; Iodine 1000mg; Iron 20,000mg; Copper 3,000mg; Manganese 40,000mg; Selenium 200mg; Zinc 30,000mg; Antioxidant 1250mg.

SBM = Soybean meal, PPSM = Pigeon Pea Seed Meal, ME = Metabolizable Energy, GNC = Groundnut cake

Table 2: Effect of Diets containing Differently Processed Pigeon Pea Seed Meal on External and Internal Egg quality Characteristics of Japanese Quail Hens (7 – 26 weeks)

Parameters	TREATMENTS 1 Control	2 Raw PPSM	3 Soaked PPSM (24hrs)	4 Soaked PPSM (48hrs)	5 Soaked PPSM (72hrs)	6 Soaked + Fermentation	7 Boiled PPPSM (60mins)	8 Roasted PPSM (30mins)	SEM
EXTERNAL QUALITY									
Egg Weight (g)	9.30	9.65	9.82	9.37	9.40	9.40	9.70	9.41	0.80^{ns}
Egg Height (mm)	30.23	30.52	30.49	30.36	30.54	30.47	30.60	30.31	0.65^{ns}
Egg Diameter (mm)	22.61	22.77	22.81	22.52	22.40	22.63	22.64	22.38	0.43^{ns}
Egg Shape Index	0.75	0.75	0.75	0.74	0.73	0.74	0.74	0.73	0.02^{ns}
Egg Shell Weight (g)	0.99	1.02	1.00	1.01	1.00	1.01	1.02	0.99	0.02^{ns}
Egg Shell Thickness (mm)	0.25	0.25	0.25	0.25	0.25	0.30	0.25	0.25	0.07^{ns}
INTERNAL QUALITY									
Albumen Height (mm)	2.77	2.89	2.77	2.92	2.92	3.18	2.84	2.89	0.45^{ns}
Albumen Diameter (mm)	32.40	32.11	33.96	32.59	31.52	32.55	33.02	33.96	1.88^{ns}
Albumen Weight (g)	4.90	5.09	5.14	5.10	4.98	4.79	5.22	4.99	5.58^{ns}
Yolk Height (mm)	9.84	9.46	9.14	9.04	9.19	9.36	9.57	9.52	1.36^{ns}
Yolk Diameter (mm)	2.21	2.17	2.19	2.19	2.21	2.22	2.20	2.17	0.06^{ns}
Yolk Weight (g)	3.42	3.56	3.68	3.25	3.43	3.60	3.51	3.44	0.41^{ns}
Yolk Index	0.44	0.43	0.41	0.41	0.41	0.42	0.43	0.43	0.06^{ns}
Haugh Unit	77.74	77.44	77.29	77.57	77.46	77.63	77.30	77.42	0.89^{ns}

abc: Means with different superscripts on the same row are significantly different (P<0.05), SEM = Standard Error of Means,
NS = Not significantly (P>0.05) different, PPSM = Pigeon Pea Seed Meal.