EGG PERFORMANCE OF JAPANESE QUAILS AS INFLUENCED BY DIETARY *ASPILIA AFRICANA* LEAF MEAL

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Abstract
This study assessed Aspilia africana leaf meal (AaLM) as potential feed additive in laying quails. 150 laying quails were randomly assigned to five experimental diets which contained AaLM at 0, 2.5, 5.0, 7.5 and 10.0% for a period of twelve weeks. Three replicates of 10 birds per replicate were housed per pen in a completely randomized design. Feed and water were offered ad libitum. One week acclimatization period was permitted prior to egg collection. Data were collected on egg production, feed intake, egg weight, egg shell thickness, yolk colour, % cracked or broken eggs and mortality. Percentages of albumen, yolk and shell to egg weight were calculated. Result revealed that there were significant (P<0.01; 0.001) influences of dietary AaLM supplementations on the egg characteristics of laying quails. Compared to the control, as level of AaLM supplementation increased, egg number, hen day production, % albumen and yolk weights and yolk colour were improved. Shell thickness increased up to 5% AaLM supplementation and thereafter as the level of Aspilia africana leaf increased to 10%, egg shell became thinner. Increasing AaLM supplementation also resulted to significant (P<0.01) decreases in egg size, % crack and % shell weight than values obtained from quails on control-fed diet. These results indicated that up to 5% Aspilia africana leaf meal supplementation could boost the egg production potentials and egg quality of laying quails.

Keywords; Phytobiotic, Browse plant, Egg quality, Japanese quails.

Introduction

Population growth, steeping urbanization and rising income are driving a global increase in demand for livestock products (Jones and Thorton, 2008). In Nigeria, the use of unconventional animal species and feed materials that are available locally and relatively cheaper has been canvassed as the means of boosting the animal protein consumption of her population (Aro *et al.*, 2008; Oko *et al.*,2011). The Japanese quail (*Coturnix coturnix japonica*), is the "quintessential micro-farmer's livestock" due to its unrivaled ability of producing meat and eggs faster and in greater quantity than any other poultry (Hoyo *et al.*, 1994). Tropical legumes and browse plants are reported as cheap sources of energy, proteins, vitamins and minerals, yolk colouring effects and phytobiotics (Fasuyi and Olorunfemi, 2008; Oko and Agiang, 2011; Oko *et al.*, 2014a and b). However, the wide applications of these leaf meals are hampered by their inherent anti-nutrient composition, high fibre and low energy contents.

Aspilia africana (Bush marigold) is one of the popular weeds in the rain forest zone of West Africa. It is an obnoxious plant which competes vigorously with cultivated crops for available nutrients with resultant decrease in crop yield. Available literature shows that the plant is a rich source of essential nutrients such as protein (Oko *et al.*, 2014a) and possesses strong antimicrobial properties (Adeniyi and Odufowora, 2000). Limited research has been conducted on its use in poultry production (Oko *et al.*, 2011; 2014b). Its employment as a feed resource and acceptance by poultry would serve as a weed controlling measure as well as a means of reducing the cost of improving the quality of poultry products. This study was designed to evaluate the effects of *Aspilia africana* leaf meal (AaLM) on the laying performance of Japanese quails.

Materials and Methods

The experiment was conducted at the poultry unit of the Teaching and Research Farm, University of Calabar, Calabar. *Aspilia africana* was obtained by harvesting whole field plant above a- 3cm stubble height within the mid vegetative to flowering stage of development as described by Oko and Agiang, (2011). The *A. africana* leaves *were plucked and sun-dried to a moisture level of less than 10%, then milled in to powder using a burr mill. Five experimental diets (Table 1) containing 0, 2.5, 5, 7.5 and 10% Aspilia africana leaf meal (AaLM) were formulated to contain 24% crude protein and 2650kcal/kg diet. Thirty, seven week–old growing quails were randomly assigned to each of the five experimental diets in a completely randomized design. Each treatment had three replicate of ten birds/ replicate. Feed and water were offered ad libitum throughout the 12 weeks of experiment.*

One week acclimatization period was permitted prior to egg collection. Eggs were *picked twice*

(9.00hrs and 16.00 hrs) daily, while feed intake and external egg qualities; egg weight, egg size, egg width, length and % cracked were monitored weekly. Two eggs from each replicate were broken and placed in flat plates for the determination of internal egg quality traits including; albumen, yolk and shell weights as percentages of egg weight. Shell thickness was measured with the micrometer screw gauge and yolk colour was determined using the Roche fan score method. Data were subjected to the one way analysis of variance and significant difference between means were separated using Duncan's multiple range test as outlined by Steel and Torrie (1980).

Results and Discussion

Results on growth performance showed that final body weight, daily weight gain, feed conversion ratio and mortality rate were significantly ($P<0.01$) influenced by dietary treatments (Table 2). Quails on 5% AaLM diet exhibited the best performance in terms of higher body weight, feed intake, feed conversion ratio and reduced mortality.

Quails on the control diet had higher value (9.61) for egg size compared to those on 7.5%, 2.5% and 5% AaLM diets, with the smallest eggs obtained from birds on 10% AaLM diet. Increasing AaLM up to 7.5% in the diet of laying quails resulted in higher ($P<0.01$) number of eggs laid, hen day production with lower number of % cracked compared to the control. This result could suggest that *Aspilia africana* leaf improved the strength of quail eggs, probably due to the presence of high amount of calcium in the leaf meal. The number of cracked or broken eggs is an important parameter which determines the hatchability and profitability of the egg enterprise. Other external traits such as egg width, egg length, shape index and egg surface area were not influenced ($P > 0.05$) by AaLM supplementation.

Albumen, yolk and shell weights as components of egg size differed ($P<0.001$) between treatments. Whereas AaLM supplementation increased ($P<0.001$) % albumen and yolk weights of quail eggs, the relative shell weight of egg was observed to decrease. Quails on 5% and 7.5% AaLM diets had higher ($P<0.001$) albumen and yolk weight, respectively relative to other dietary treatments. Compared to the control, relative shell weight tended to decrease in quails on AaLM diets indicative of an improvement in eggs quality in terms of proportions of yolk and albumen to shell. The inclusion of 2.5 - 5% AaLM in the diet improved the shell thickness (0.30mm) of quail eggs compared to value obtained for the control (0.29mm) which was similar to value obtained following 7.5 – 10% supplementation. The thickness of the egg shell is a determining factor to its degree of breakage during laying, handling or transportation. Visual assessment of yolk colour using the Roche colour fan score showed progressive yellowish colour intensity in egg yolk with increasing AaLM supplementation. This suggested the presence of xanthophylls, beta-carotene and tocopherol (which are pigmentation agents responsible for yellow colouration of egg yolk) in *Aspilia africana* leaf. Quails on 10% AaLM had the highest value for yolk colour (6.25) compared to the value (3.03) obtained from birds on the control diet.

At increasing level of AaLM supplementation, moisture, ash and nitrogen free extract contents of quail eggs increased with significant reduction in fat content, whereas crude protein content remained unchanged (Table 3). Kaijage *et al.* (2002) report however showed significant improvement in the crude protein content of eggs from hen fed *Moringa oleifera* leaf-supplemented diets. The report of Akande *et al.* (2007) also demonstrated improvement in egg characteristics of birds fed diets containing up to 7.5% *Tephrosia bracteolate* leaf meal. Whereas, Sadi *et al.* (2008) showed that supplementations with peppermint leaf meal had no significant effect on the egg characteristics of laying birds. This implies that the production ability of laying birds could vary due to the active components present in the different leaf meals.

Conclusion

From the result, it appears that *Aspilia africana* leaf meal has the potential to boost egg production in laying quails and further supports the opinion that leaf meal is a natural source of egg pigmenting and egg boosting factors in poultry production. The study concludes that dietary supplementation of up to 5% *Aspilia africana* leaf meal improved egg production ability and egg qualities of laying quails.

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Table 1. Composition of layer diets (%).

Feed ingredients	0%	2.5%	5%	7.5%	10%
Maize	37.80	36.25	33.93	32.01	30.08
Soybean meal	41.70	41.25	40.56	39.99	39.42
Aspilia africana leaf meal (AaLM)	0.00	2.00	5.00	7.50	10.00
Crayfish dust	5.00	5.00	5.00	5.00	5.00
Palm kernel cake	2.00	2.00	2.00	2.00	2.00
Wheat offal	4.00	4.00	4.00	4.00	4.00
Bone meal	4.00	4.00	4.00	4.00	4.00
Limestone	4.00	4.00	4.00	4.00	4.00
Vitamin premix*	0.50	0.50	0.50	0.50	0.50
Salt	0.50	0.50	0.50	0.50	0.50
Lysine	0.30	0.30	0.30	0.30	0.30
Methionine	0.20	0.20	0.20	0.20	0.20
Total amount	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated Composition					
% CP	24.00	24.00	24.00	24.00	24.00
Metabolizable energy (kcal/kg)	2650	2650	2650	2650	2650

Formulations are representative of 0% AaLM (Treatment 1); 2.5% AaLM (Treatment 2); 5% AaLM (Treatment 3); 7.5% AaLM (Treatment 4) and
10% AaLM (Treatment 5).

*Vitamin premix (Romix 124/V) amount supplied per kg: Vitamin A 15,000,000IU; Vitamin D_3 3,000,000IU; Vitamin E 15,000IU;
Vitamin K_3 2.5g; Vitamin B_1 1g; Vitamin B_2 10g; Vitamin B_{12} 4g; Folic Acid 2g; Biotin 0.1g; Niacin 70g; BHT 125g;
Calcium –D- Panthotenic Acid 20g

Table 2. Effects of *Aspilia africana* leaf meal on the egg characteristics of laying quails.

Egg Characteristics	0%	2.5%	5%	7.5%	10%	Sem	LSD	Level of Sig.
Final body weight (g)	157.08^{a}	135.67^{d}	150.79^{b}	139.72^{b}	138.45^{bc}	2.54	3.92	**
Daily weight gain (g/day)	0.30^{a}	0.10^{c}	0.29^{a}	0.19^{b}	0.16^{b}	0.02	0.05	**
Daily feed intake (g/day/b)	1.69	1.62	1.63	1.63	1.60	0.08	0.43	NS
Feed conversion ratio	5.63^{a}	8.10^{b}	5.62^{a}	8.58^{b}	10.00^{a}	0.08	2.18	*
Mortality (%)	8.75^{a}	0.00^{d}	2.77^{c}	5.56^{b}	8.33^{a}	0.86	0.15	**
External egg qualities								
Egg size (g/day)	9.61^{a}	9.23^{b}	9.15^{bc}	9.37^{a}	8.92^{c}	0.81	0.26	**
Egg number (g/day)	84.63^{c}	100.40^{a}	104.88^{b}	133.1^{a}	76.25^{d}	7.16	6.85	*
Hen day prod. (%)	61.38^{a}	69.64^{b}	72.55^{b}	78.80^{a}	56.14^{d}	2.19	3.44	***
Egg width (mm)	24.08	24.68	23.96	23.53	23.56	0.16	0.45	NS
Egg length (mm)	30.95	30.99	30.34	29.65	30.21	0.28	1.36	NS
Shape index (%)	77.80	79.64	78.94	79.36	77.99	0.27	2.32	NS
Egg surface area (mm^2)	22.38	22.38	22.05	21.59	21.59	0.24	2.41	NS
Crack %	0.87^{a}	0.79^{a}	0.78^{a}	0.75^{a}	0.70^{b}	0.01	0.18	*
Internal egg qualities								
Albumen weight (%EW)	47.80^{e}	51.08^{d}	50.27^{c}	53.73^{a}	52.0^{b}	0.02	0.05	***
Yolk weight (%EW)	30.63^{d}	33.38^{b}	34.64^{a}	30.88^{c}	30.50^{e}	0.01	0.03	***
Shell weight (%EW)	21.57^{a}	15.54^{c}	15.09^{e}	15.39^{d}	17.49^{b}	0.04	0.12	***
Shell thickness (mm)	0.29^{b}	0.30^{a}	0.30^{a}	0.29^{b}	0.29^{b}	0.03	0.01	*
Yolk index (%)	41.00^{c}	41.00^{c}	42.00^{b}	41.00^{c}	45.00^{a}	0.06	0.52	*
Yolk colour	3.03^{e}	3.25^{d}	5.75^{c}	5.99^{b}	6.25^{a}	0.02	0.08	***

Different superscripts (a,b,c, d and e) indicate significant (P<0.05, 0.01, 0.001) differences between treatments.
%EW = Percentage Egg Weight.

Table 3. Effects of *Aspilia africana* leaf meal on the egg composition of laying quails.

Composition (%)	0%	2.5%	5%	7.5%	10%	Sem	LSD	Level of Sig.
Dry matter	30.74^{a}	27.75^{c}	27.86^{c}	28.59^{b}	30.43^{a}	1.20	0.41	*
Moisture	69.26^{c}	72.25^{a}	72.14^{a}	71.41^{b}	69.57^{c}	1.22	0.32	*
Crude protein	46.83	46.65	46.72	46.91	47.68	2.26	1.64	NS
Ash	1.22^{b}	1.15^{c}	1.19^{bc}	1.28^{b}	2.20^{a}	0.35	0.11	*
Crude fat	38.14^{a}	37.92^{a}	36.77^{b}	35.66^{c}	33.72^{d}	1.94	0.53	**
Nitrogen free extract	13.81^{c}	14.28^{c}	15.32^{b}	16.15^{a}	16.40^{a}	2.26	0.61	*

Different superscripts (a,b,c and d) indicate significant (P<0.05, 0.01) differences between treatments.