NUTRIENT DIGESTIBILITY AND EGG QUALITY OF LAYING HENS FED RAW *ANTHONOTHA MACROPHYLLA* SEED MEAL (AMSM) BASED DIET

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ABSTRACT
Egg quality and nutrient utilization of laying hens fed raw *Anthonotha macrophylla* seed meal were evaluated in an 8week trial involving a total number of 120 laying hens in a completely randomized design. Four layer rations were formulated and made in such a way that T_1 (Control) contained no *Anthonotha macrophylla* seed meal while diets T_2, T_3 and T_4 contained 4 %, 8 % and 12 % *Anthonotha macrophylla* seed meal respectively. Each group of hens contained 30 layers which were further sub-divided into three replicates of 10 hens each. Results obtained in the digestibility trial showed significant ($P<0.05$) differences in all the parameters measured except in dry matter digestibility. However digestibility coefficient of crude protein, ether extract, crude fiber, ash and nitrogen free extract of hens fed diet 3(8 % AMSM) was significantly higher than others. Egg quality indices (egg weight, length, index, shell thickness, yolk weight, yolk height were not affected by the experimental diets ($P>0.05$). The findings indicate that raw *Anthonotha macrophylla* seed meal had no negative effect on the quality of eggs produced and also could be incorporated into layers ration at 8% level of inclusion without any negative effect on nutrient digestibility.
Keywords: *Anthonotha macrophylla*, egg quality, nutrient digestibility, laying hens.

Introduction

The need to reduce competition between animals and man for available feed raw materials has propelled the search for alternative raw materials (Tona et al., 2003). This is due to the rising
need of man for the same livestock feed material for his food and industrial raw material. With increasing interest in finding new alternate protein source, the wild underutilized legumes receive more attention, which offer a good scope to meet the ever increasing demands for protein source (Janardhanan et al., 2003; Ezeagu et al., 2003; Pugalenthi et al., 2004). Expenses incurred on feed constitute 70-80% of the livestock farm recurrent expenditure. The present shortage of monogastric animal feed has been blamed on the increasing cost of conventional sources of ingredients. The price of these conventional ingredients have soared so high in recent times that it is becoming uneconomical to use them in poultry feeds (Opara, 1996; Esonu et al., 2001). As a result of this, research efforts are being geared towards evaluating alternative feed ingredients that are not competed for by man, in other to reduce production cost which will result in reduced cost of animal products. One of such useful alternative raw materials is *Anthonatha macrophylla*, locally called ububa in Igbo and aba in Yoruba. This plant contains appreciable amount of nutrients (Durunna, 2005), the crude protein (27.74%) and energy (4.69kcal/g) content of the seed makes it a potential feedstuff and the high crude protein content of this feedstuff makes it a good source of protein in layers ration. This research is aimed at evaluating the nutrient digestibility and egg quality of laying hens fed raw *Anthonotha macrophylla* seed meal based diets.

Materials and Methods

Experimental site

The experiment was carried out at the Poultry Unit of Faculty of Agriculture Teaching and Research Farms, Abia State University, Umudike Campus. Umudike bears a coordinate of 7°31¹ East and 5°28¹ North and lies at an altitude of 122 meters above sea level, annual rainfall ranges from 1900-2200mm (Njoku et al., 2001).

Experimental Diets

Mature *Anthonotha macrophylla* seeds were gathered from the wild within Isiala Oboro in Ikwuano Local Government of Abia State. The plants are very common and widely distributed in the bush where they serve as a source of firewood and part of the traditional bush fallow system. The raw seeds were sundried for 5 days, chopped and milled using a hammer mill with a sieve size of 4.15mm to produce the *Anthonotha macrophylla* seed meal (AMSM). Four experimental diets were formulated by incorporating AMSM at 0, 4, 8 and 12% dietary levels for diets T_1, T_2, T_3 and T_4 respectively. The composition of the experimental diets is shown in Table 1. The determined proximate composition of raw AMSM and experimental diets are presented in Tables 2 and 3 respectively.

Experimental Design

A total of one hundred and twenty (120) laying hens were used for the experiment. The birds were divided into four groups of thirty hens each and assigned to four treatment diets in a completely randomized design (CRD). Each group was further sub-divided into three

replicates of ten hens each. Feed and water were offered *ad libitum* and the feeding trial lasted 8weeks.

Data collection

The nutrient digestibility was determined in the 8th week of the experiment. During this period, the faeces voided out were collected for 7days. The collected faecal samples were weighed, sundried and taken to the laboratory for chemical analysis. The eggs for quality analysis were collected over an eight week period. Individual eggs were labeled and weighed using an electronic balance. External and internal egg quality parameters were measured as described by Ayanwale and Gado (2001) and Iyayi and Taiwo (2003).

Data Analysis

Data obtained were subjected to statistical analysis using one-way analysis of variance (ANOVA) as outlined in (Steel and Torrie, 1980). Duncan multiple range test was used to separate significant treatment means where they occurred (Obi, 2002).

TABLE 1: **Composition of Experimental Diets (%)**

	AMSM Inclusion Levels in Diets (%)			
Ingredient	0(T_1)	4(T_2)	8(T_3)	12(T_4)
Maize	50.00	50.00	50.00	50.00
Soybean meal	20.00	16.00	12.00	8.00
AMSM	0.00	4.00	8.00	12.00
Fish meal	3.00	3.00	3.00	3.00
Wheat bran	15.00	15.00	15.00	15.00
Palm kernel cake	7.00	7.00	7.00	7.00
Bone meal	3.00	3.00	3.00	3.00
Salt	0.50	0.50	0.50	0.50
Premix*	0.50	0.50	0.50	0.50
Methionine	0.50	0.50	0.50	0.50
Lysine	0.50	0.50	0.50	0.50
Total	100.00	100.00	100.00	100.00
Calculated composition				
Crude protein (%)	19.50	18.19	17.22	17.30
Metabolizable energy (MJ/kg)	11.30	11.39	11.55	11.71

*Vitamin mineral premix provides per kg diet: Vit. A, 13.340 iu, Vit D_3 2680 iu, Vit E 10 iu, Vit. K, 2.68 iu, Calcium penthenate, 10.68mg, Vit. B_{12} 0.022mg; Folic acid, 0.668mg; Chorline Chloride 400mg; Chlorotetracycline, 26-28mg; Manganese, 133.34mg; Iron, 66.68mg;Zinc, 53.34mg Copper, 3.2mg;Iodine, 1.86mg; Cobalt, 0.268mg; Selenium, 0.108mg. AMSM = *Anthonotha macrophylla* seed meal.

Table 2: Determined proximate composition of experimental diets

	AMSM inclusion levels in the diets (%)			
Parameter	0(T_1)	4(T_2)	8(T_3)	12(T_4)
Dry matter (%)	89.74	90.17	90.26	90.09
Crude protein (%)	17.32	17.27	17.19	17.01
Crude fibre (%)	8.47	7.94	7.71	6.82
Ether extract (%)	3.17	2.97	3.31	3.21
Ash (%)	6.45	5.86	7.27	8.36
Nitrogen free extract (%)	64.59	55.46	54.78	54.69
Metabolizable energy (MJ/kg)*	13.35	11.92	11.95	11.84

AMSM – *Anthonotha macrophylla* seed meal, NFE – Nitrogen free extract, NFE – Nitrogen free Extract, ME – Metabolizable energy, *Calculated according to Pauzenga as ME (MJ/kg) = 37 × % CP + 81 × % EE + 35.5 × % NFE.

Table 3: Proximate composition of raw *Anthonotha macrophylla* seed meal (AMSM)

Parameters	Raw AMSM
Dry matter (%)	90.51
Crude protein (%)	20.88
Crude fibre (%)	3.81
Ether extract (%)	6.25
Ash (%)	8.71
Nitrogen free extracts (%)	60.35
Metabolizable energy (MJ/kg)	14.31

RESULTS

Nutrient digestibility of laying hens fed graded levels of *Anthonotha macrophylla* seed meal (AMSM)

The nutrient digestibility results are presented in Table 4. There were significant ($P<0.05$) differences in all the digestibility parameters measured except in dry matter (DM) digestibility. The digestibility values of dry matter (DM), crude protein (CP), ether extract (EE), crude fiber (CP), ash and nitrogen free extract (NFE) were high in all the diets. Hens on T_3 (8%AMSM) had the highest digestibility coefficient for DM (90.26%), CP (86.27%), EE (81.52%), CF (81.73%), ash (81.77%) and NFE (81.82%), while hens on treatment 4(12%) recorded the lowest digestibility value for crude protein (70.90%).

Quality parameters of eggs of hens fed graded levels of raw *Anthonotha macrophylla* seed meal (AMSM)

Table 5 showed the results of feeding raw *Anthonotha macrophylla* seed meal on egg quality parameters. There were no significant ($P>0.05$) effects on egg size as estimated by egg weight (g), length, width, index and shell thickness. Likewise yolk weight, height, width, index, albumin weight, height as well as the haugh units were not significantly altered by feeding laying hens with raw *Anthonotha macrophylla* seed meal (AMSM) based diet.

Table 4: Nutrient digestibility of laying hens fed graded Levels of raw *Anthonotha macrophylla* seed meal (as % DM)

	AMSM Inclusion Levels in Diets (%)				
Parameter	0(T1)	4(T2)	8(T3)	12 (T4)	SEM
Dry matter (%)	89.74	90.17	90.26	90.09	0.22
Crude protein (%)	78.68^{b}	76.14^{c}	86.27^{a}	70.90^{d}	0.14
Ether extract (%)	76.00^{c}	76.29^{b}	81.52^{a}	76.43^{b}	0.78
Crude fibre (%)	75.87^{c}	76.38^{b}	81.73^{a}	76.43^{b}	0.20
Ash (%)	75.92^{b}	76.20^{b}	81.77^{a}	76.38^{a}	0.10
Nitrogen free extract (%)	75.94^{b}	76.21^{b}	81.77^{a}	76.37^{b}	0.14
M.E (MJ/kg)	75.75^{c}	76.39^{b}	81.82^{a}	77.86^{b}	0.14

$^{a\,b\,c\,d}$ Means in the same row with different superscripts differed significantly ($p<0.05$).
AMSM - *Anthonotha macrophylla* seed meal, ME = Metabolisable energy.

Table 5: Egg quality parameters of laying hens fed diets containing graded levels of raw *Anthonotha macrophylla* (AMSM)

Parameter	AMSM Inclusion Levels in Diets (%)				SEM
	0(T_1)	4(T_2)	8(T_3)	12(T_4)	
Egg weight (g)	55.88	56.71	55.62	56.06	0.72
Egg length (cm)	55.07	55.40	54.19	55.14	0.51
Egg index	0.74	0.74	0.88	0.73	0.51
Shell thickness (mm)	30.53	30.11	31.22	28.86	0.75
Yolk weight (g)	14.04	13.94	13.66	13.93	0.16
Yolk height (cm)	13.21	13.53	13.75	13.72	0.52
Yolk index	0.36	0.37	0.41	0.37	0.02
Albumin weight (g)	36.62	37.01	37.10	36.73	0.47
Albumin height (cm)	6.98	7.19	7.28	6.84	0.21
Haugh unit	83.01	84.31	85.14	82.30	1.22

[a b c d] Means in the same row with different superscripts differed significantly ($p<0.05$).
AMSM – *Anthonotha macrophylla* seed meal. SEM-Standard error of the means, ST = shell thickness, AH = Albumin height.

Discussion

The high values of dry matter and digestibility coefficient of crude protein, ether extract, crude fiber, ash and nitrogen free extract obtained in this study indicated that *Anthonotha macrophylla* seed meal is well digested by the hens. High CP, EE, CF, Ash and NFE utilization of laying hens on treatment 3 (8%AMSM) when compared to diets T_1 (0%), T_2 (4%AMSM) and T_4 (12%AMSM) is an indication of increased intake, efficient utilization of the feed and limited content of toxic substances, since the hazardous effect of these substances range from a reduction in feed intake and nutrient absorption to interference of some biochemical processes and depressed growth (D'Mello, 1995). Efficient utilization of this feedstuff peaked at 8% level of inclusion indicating that the test ingredient was efficiently utilized at that level.

The quality indices of eggs of hens fed diets containing graded levels of AMSM showed that the test material does not have any effect on the parameters measured. This agreed with the reports of Tuleun et al. (2008) who reported no significant ($P>0.05$) effects on external and internal qualities of laying hens fed variously processed *Mucuna* seed meal. The non-significant result obtained in the quality parameters indicated that raw *Anthonotha macrophylla* seed meal did not interfere with the process of laying and the quality of the eggs. It also indicated that the raw seed meal could be incorporated into layers ration at levels up to 12% without any negative effect on the quality of eggs laid.

Conclusion

In conclusion, the digestibility study showed that AMSM was digested and efficiently utilized by the hens. However, the best digestibility result was recorded in hens fed (8%AMSM), therefore AMSM could be incorporated into layers ration at up to 8% level of inclusion without deleterious effect on the nutrient utilization. Raw *Anthonotha macrophylla* seed

meal (AMSM) inclusion in the diet of laying hens at 4%, 8% and 12% did not alter the egg quality of the hens and hence could be incorporated into layers ration up to 12% without any deleterious effect on the egg quality.

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