EFFECT OF COOKED *MUCUNA SLOANEI* SEED MEAL ON THE PERFORMANCE AND EGG QUALITY CHARACTERISTICS OF LAYING HEN

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Abstract

Hamburger (*Mucuna sloanei*) seed a tropical legume crop that is presently used as a soup thickner, was used to substitute soya bean meal in laying hen diet. The performance of the hen, the egg quality characteristics and egg biochemistry were examine in a 12 week feeding trial. The cooked *Mucuna sloanei* seed meal was analyzed for its chemical compositions and incorporated into a layer diets at 0.0, 5.0, 10.0 and 15.0 % (T1, T2, T3 and T4) inclusion levels, respectively. A total of 120 laying hen of 22 weeks old were divided into four groups of 30 birds each. Each group was further divided into 3 replicates of 10 birds and fed the diets in a complete randomized design. T4 hens had a significant ($P < 0.05$) highest hen day egg production. All the egg quality characteristics analysed were similar ($P > 0.05$) among the treatment groups except egg size which significantly ($P < 0.05$) reduced in T4 though still within the same category of medium in USDA egg rating. The egg biochemistry showed a significant ($P < 0.05$) reduction in cholesterol and increase in total protein for eggs from hen fed the treatment diet. It was concluded that cooked *Mucuna sloanei* seed meal is an ideal ingredient to substitute soya bean meal in layers diet and could also be used to modify the biochemical constituent of eggs.

Key words: Egg biochemistry, *Mucuna sloanei*, Laying hen, Performance, Diet

Introduction

The low level of animal protein intake in the human diets of most developing countries of the world, to which Nigeria belongs, has continued to pose problems. Food and Agriculture Organization (FAO) statistical report (2017) acknowledged that dietary energy of Nigerian diets is not the eminent problem, but rather dietary protein and ranked Nigeria as second (Ethiopia being first) among the top 20 African countries with the highest prevalence of undernourishment in the year 2014 to 2016. Nigeria is the largest producer of egg in Africa (FAOSTAT, 2017) but an average Nigerian consume less than 80 eggs per person annually (Vanguard, 22 July, 2017), while Japaness which ranked the highest in the world for egg consumption, consume an average of 320 eggs, followed by Paraguay (309), China, Mexico and the United States consume over 300 eggs per person annually (Sawe, 2018). These reports, reflect a critical picture for Nigeria in the area of animal protein (egg) consumption. To address this striking problem, developing the poultry industry is eminent. Developing the poultry industry is engrossed with limiting factors among which is cost of feeding which accounts for over 70% of the total cost of poultry production (Madubuike, 2012). This ugly situation, has necessitated the need to identify some feed ingredients that can be used in alternative to the already established feed ingredients whose cost is now too high due to pressure on their usage by other sectors. *Mucuna sloanei*, commonly called Ukpo/Okobo by the Igbo community in sub-Sahara Africa is one of the under-utilized feed ingredient that has the potential to fit into feed ingredients in poultry industry. This research therefore, understudied the effect of cooked *Mucuna sloanei* seed meal on the performance of laying hen and its egg quality characteristics.

Materials and methods

The study was conducted at the Teaching and Research Farm of the Imo State Owerri in the rain forest belt of Nigeria. The *Mucuna sloanei* seeds were processed by first cracking the hard seed coat in a hammer mill.

The seeds were cooked in boiling water for 30 minutes and the seeds became soft. The seed coats were separated, the seeds were dried in an oven to crispiness and were then taken to hammer mill for milling to obtain the *Mucuna sloanei* meal. Sample of the cooked *Mucuna sloanei* seed meal was analyzed for the proximate composition according to AOAC (2000) and then used to formulate the experimental diets. Four experimental diets were formulated for the experiment. *Mucuna sloanei* seed meal substituted soya bean meal in each of the diets at 0%, 5%, 10% and 15% on weight for weight basis, as T_1, T_2, T_3 and T_4. The ingredient composition of the diets is presented in table 1.

Table 1. Ingredient Composition of the experimental diets

Ingredients	Treatment levels in %			
	T_1(0.00)	T_2(5.00)	T_3(10.00)	T_4(15.00)
Yellow maize (9% CP)	40.00	40.00	40.00	40.00
Soya bean meal (44% CP)	15.00	10.00	5.00	0.00
Mucuna sloanei Meal(26.1% CP)	0.00	5.00	10.00	15.00
Groundnut cake (45% CP)	7.00	7.00	7.00	7.00
Palm Kernel Cake (18% CP)	15.00	15.00	15.00	15.00
Wheat Bran (17 % CP)	9.00	9.00	9.00	9.00
Fish Meal (63% CP)	2.00	2.00	2.00	2.00
Oyster shell	3.00	3.00	3.00	3.00
Bone Meal	8.00	8.00	8.00	8.00
Common Salt	0.25	0.25	0.25	0.25
*Vit/mineral Premix	0.25	0.25	0.25	0.25
DL-Methionine	0.25	0.25	0.25	0.25
L Lysine	0.25	0.25	0.25	0.25
Total	**100**	**100**	**100**	**100**
Calculated nutrients composition of the diets (%)				
Crude Protein	18.84	17.95	17.05	16.16
Crude Fiber	4.91	4.74	4.58	4.41
Calcium	4.18	4.19	4.20	4.21
Phosphorus	1.62	1.60	1.58	1.56
Lysine	1.22	1.30	1.39	1.48
Methionine	0.62	0.81	1.00	1.19
**Metabolizable Energy (kcal/g)	2488.48	2541.63	2594.78	2647.96

*Note. * To provide the following per kilogram of feed; vit A 10,000IU; vit. D3 1,500 IU; vit. E 2 mg; riboflavin 3 mg; pantothenic acid 10 mg; nicotinic acid, 2.5 mg; choline 3.5 mg; folic acid 1mg; magnesium 56 mg; lysine 1 mg; iron 20 mg; zinc 50 mg; cobalt 1.25 mg. **The metabolizable energy of the test ingredient was calculated using prediction equation as reported by Pauzenga, 1985 with the formula M.E = 37 × %CP + 81.8 × %EE + 35.5 × %NFE.*

A total of 120 Isa brown pullets of twenty two weeks old, were used for this experiment. The 120 pullets were divided into 4 experimental group of 30 pullets each and further replicated 3 times to give 10 pullets per replicate. The groups were randomly assigned to the four experimental diets and were housed in a battery cage, each measuring 35cm X 46cm X 40cm at 5hens per cage. The birds were stabilized by gradual introduction of the experimental feed before commencement of data collection and normal routine management practices and medications were strictly adopted. A 15hour day light program was adopted and egg collection was done twice daily (morning and evening hours). The investigation lasted for 12 weeks. The performance parameters and the quality of the produced eggs were investigated.

The egg biochemical analyses was carried out using the specific Randox reagent kit, test tubes, Eppendorf automatic pipettes and ACUREX minilab biochemistry Analyzer.

The data obtained from this study, were subjected to statistical analysis using analysis of variance procedure as recommended by Steel and Torrie (1980), and computed with IBM SPSS statistical 22 of 2013 software.

Results and Discussion

The result of the proximate composition of the *Mucuna sloanei* seed meal used for the experiment is presented in table 2. The result showed that the valuesof the nutrients were within the levels obtained by Ezeagu *et al.* (2003) and Tuleun *et al.* (2008).

The result of the performance of the laying hen is presented in table 3. The result showed that there was no significant difference ($P > 0.05$) in the final body weight of the hens. Hens in T_4 group produced a significantly ($P < 0.05$) highest number of eggs within the experimental period, which was an average of 59.92 eggs, followed by T_2 which was 54.32 eggs while the production for T_1 and T_3 were similar. The finding is in-line with the report of Muhammad *et al.* (2015) and Effiong, William & Eyoh (2015). The weight of eggs from T_4 group were significantly ($P < 0.05$) smaller than the weight of eggs from the rest of the treatment groups contrary to Effiong *et al.* (2015). However, all the eggs obtained from the present research were within the same category of medium in the United State Department of Agriculture (USDA)

Table 3. Performance of the Hen fed different levels of cooked *Mucuna sloanei* seed meal

Parameters	Treatment levels (%)				
	T_1(0.00)	T_2(5.00)	T_3(10.00)	T_4(15.00)	SEM
Av. Initial Body wt (g)	1653.33	1663.33	1650.00	1656.67	22.73
Av. Final body wt (g)	1666.67	1673.33	1667.37	1606.67	0.02
Av. Feed intake (g/day)	94.16^{b}	95.03^{b}	95.17^{b}	98.04^{a}	0.47
Av. No of eggs/bird within 84days	50.4^{c}	54.32^{b}	51.52^{c}	59.92^{a}	0.08
Av. Hen day egg production (%)	60.00^{d}	64.66^{b}	61.33^{c}	71.33^{a}	0.82
Av. Egg wt (g)	56.43^{a}	56.42^{a}	56.44^{a}	49.38^{b}	1.58
Feed Conversion Ratio (*gfeed/g egg*)	1.67^{a}	1.68^{a}	1.69^{a}	1.99^{b}	0.04
Mortality	-	-	-	-	

Note. Without superscript = not significant. Means with different superscript in the same row differ significantly (P < 0.05). SEM = Standard Error Mean. Av= Average. Wt = weight.

(2000).

The result of the egg quality characteristics of the eggs produced by hen fed with diets containing different levels of cooked *Mucuna sloanei* seed meal is presented in table 4. All the parameters analysed had no significant difference ($P > 0.05$) which comform with Effiong, William & Eyoh (2015) The result of egg biochemistry is presented in table 5. The result showed a significant progressive drop in the yolk cholesterol content of the egg as the inclusion rate of the test ingredient increased. Many research results have reported a positive influence on egg cholesterol by nutrition (Sanda, 2015; Singh *et al.*,2013; Vidal *et al*., 2013). The decline in cholesterol could be as a result saponin, a phytochemical contained in *Mucuna sloanei* which has been reported as having the ability to form insoluble complexes with cholesterol in the digesta and which also inhibits the intestinal absorption of endogenous and exogenous cholesterol (Oakenfull *et al.*, 1990). The egg globulin progressively increased in value as the inclusion rate of the test ingredient increased which is an indication of adequacy of cooked *Mucuna sloanei* seed meal on egg biochemical constituents.

Table 4. Egg quality characteristics from the hen fed different levels of cooked *Mucuna sloanei* seed meal

Parameters	Treatment levels (%)				
	T_1(0.00)	T_2(5.00)	T_3(10.00)	T_4(15.00)	SEM
Av. Egg weight (g)	56.43^{a}	56.42^{a}	56.44^{a}	49.38^{b}	1.58
Shell thickness (mm)	0.37	0.36	0.36	0.35	0.02
Albumin height (mm)	5.79	5.94	5.70	5.90	0.10
Albumin diameter (cm)	3.76	3.73	3.75	3.72	0.03
Haugh unit	89.95	90.57	89.37	90.03	0.68
Yolk diameter (cm)	3.74	3.67	3.76	3.68	0.04
Yolk height (cm)	1.49	1.51	1.50	1.52	0.01
Yolk index (height/diameter)	0.40	0.43	0.40	0.42	0.03

Table 2. proximate composition of cooked *Mucuna sloanei* seed meal

Nutrient	Proximate composition (%DM)

Table 5. Biochemistry of egg from the hen fed different levels of cooked *Mucuna sloanei* seed meal

Parameter	Treatment levels (%)				
	T_1(0.00)	T_2(5.00)	T_3(10.00)	T_4(15.00)	SEM
Cholesterol (mmol/L)	26.70^a	26.70^a	26.10^b	25.40^c	0.17
Total Protein (g/dl)	57.60^b	60.10^{ab}	59.00^b	63.40^a	2.16
Albumin	28.20^b	29.40^a	26.90^d	27.90^c	0.11
Globulin	29.40^a	30.70^c	32.10^b	35.50^a	0.20
Egg yolk colour	8	7	8	8	0.13

Note. Without superscript = not significant. Means with different superscript in the same row differ significantly ($P < 0.05$). SEM = Standard Error Mean. Av. = Average

Conclusion and Recommendation

Based on the findings of this research it can be concluded that cooked *Mucuna sloanei* seed meal is ideal to replace soyabean meal up to 100% in layers diet. In addition, cooked *Mucuna sloanei* seed meal was found to have the tendency of modifying the cholesterol and globulin content of egg hence could be used in producing specialty egg.

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