

**ORIGINAL RESEARCH ARTICLE****Replacement value of soyabean meal with raw sand box (*Hura crepitans*) seed meal in laying hen diets*****Esonu, B.O., Ozeudu, E., Uchegbu, M.C., Chibuike, C.E., and Ojike, F.C.***Department of Animal Science and Technology
Federal University of Technology, Owerri, Nigeria***Corresponding Author: Email: - esonubabs@yahoo.com; Phone:- 08033199635***ABSTRACT**

*An experiment was conducted to evaluate the partial substitution of soyabean meal with raw sandbox (*Hura crepitans*) seed meal on the performance of laying hens. Four experimental layers' diets were formulated such that the raw sandbox seed meal was used to substitute soyabean meal at 0%, 10%, 15% and 20% dietary levels, respectively. One hundred and twenty two Shika Brown laying hens, 32weeks old were randomly divided into four treatment groups and assigned to the four diets in a completely randomized design. Each treatment was in three replicates of ten hens each. Feed and water were given ad libitum for 12 weeks. Data on feed intake, body weight gain, hen-day egg production, egg weight, feed conversion ratio, egg quality and internal organ characteristics were collected. There was no significant ($P>0.05$) difference in the performance of the groups on the 0% and those on the substitution levels in all the parameters measured, except in body weight gain. Feed intake, feed conversion ratio, hen-day egg production (%) and egg weights of the groups on the partial substitution levels of soyabean meal with raw sandbox meal compared favourably with the 0% group. Hens on the 0% group diet recorded higher values which were however not statistically different ($P>0.05$) except in body weight gain. The organ weight analysis and egg quality characteristics (both external and internal analysis) of the birds on partial substitution levels of soyabean meal with raw sandbox meal compared favourably with the 0% group. Therefore, raw sandbox seed meal could partially substitute soyabean meal at 20% dietary level in laying hen diets comparing favourably with the 0% group.*

Keywords: Sandbox seed meal, Substitution level, Soyabean, Laying hens performance.**INTRODUCTION**

The Nigerian livestock sub-sector represents a major national investment with important socio-economic and nutritional implications. Commercial livestock had been a well developed and very popular enterprise (at least up till mid 1982) with satisfactory returns on investments even when production was low. Since then, the commercial poultry and swine industry underwent remarkable growth and development but most of the gains in size and structure made prior to mid-eighties have been lost due to cost-price squeeze arising from shortages and high prices of feeds. The major reason for this scarcity and increased cost of poultry feed has been attributed to increased competition between humans, livestock and industries for major and conventional feedstuffs such as maize, soyabean, and many others, which supply the protein, energy and other nutritional needs of the birds (Esonu *et al*, 2001). This has led to increase in production cost of livestock products in Nigeria and

consequently animal products are expensive to majority of the population (Hahns *et al*, 1988; Emenalom *et al*, 2004; Esonu *et al*, 2005).

There is an urgent need to replace these costly conventional feed ingredients with cheap and locally available unconventional feed resources. One of such is the seed of sand box tree (*Hura crepitans*), also known as possumwood and Jabillo (Ozeudu *et al*, 2015; Esonu *et al*, 2014). It is a shady and evergreen tree of the family Euphorbiaceae with thorny trunk. The fruits are pumpkin shaped and seeds are flattened and known as 'Dynamite Tree' for the explosive sound the ripe fruit makes as it splits into segments (Feldkamp, 2006). Sandbox seed contains high quality protein and oil in a range of 22.00-37.64% to 43.52-53.81%, respectively (Yaakugh *et al*, 2001; Fowamola and Akindahunsi, 2007; Muhammed *et al*, 2013). This study was designed to evaluate the replacement value of soyabean meal with raw sandbox seed meal in laying hen diets.

MATERIALS AND METHODS

The experiment was conducted at the Teaching and Research Farm, School of Agriculture and Agricultural Technology (SAAT), Federal University of Technology, Owerri, Imo State, Nigeria. Owerri is in the South-Eastern geographical zone of Nigeria in the humid tropical area of West Africa and is situated on longitude 7° 01' 06" E and 7° 03' 00" E and latitude 5° 28' 24"N and 5° 30' 00"N and altitude of 90m. The mean annual rainfall temperature and relative humidity are 2500mm, 26.5-27.5°C and 70 – 80%, respectively. The dry season duration is five months and annual evaporation is 1450mm. The soil texture is sandy loam with an average Ph of 5.5 (Ministry of lands and Survey Atlas of Imo State, 1984). The raw matured sandbox seeds were harvested from Ohaji Village in Ohaji/Egbema local government area of Imo state.

The raw seeds were sun dried for three days and then crushed in a hammer mill with a sieve size of 3.36mm to produce raw sand box seed meal. Proximate composition of the raw sandbox seed meal was determined using the standard methods (AOAC, 2000) and presented on Table 1.

Experimental Diets and Hens:

The raw sandbox seed meal so prepared (Table 1) was used to formulate four experimental layers diets such that the diets contained 0, 10, 15 and 20% substituting soyabean meal in the diets, respectively. Other ingredients were adjusted such that the diets were iso-nitrogenous and nutrient requirement of the laying hens met. The ingredients and chemical composition of the experimental diets are shown in Table 2.

One hundred and twenty, 32-week old Shika Brown laying hens, were randomly divided into four groups of thirty hens each and assigned to the four treatments in a completely randomized design. Each treatment was sub-divided into three replicates of ten hens each. Feed and water were provided *ad libitum*. The hens were weighed at the beginning of the experiment and weekly thereafter, while feed intake was recorded daily. Eggs were collected twice daily (9.00am and 3.00pm) and weighed. Five eggs from daily collections from each treatment were randomly selected and evaluated daily for external (egg weight, horizontal circumference and oblong circumference) and internal (shell thickness, yolk index, Albumen index, Haugh

unit and yolk colour) egg characteristics. The egg weight was measured using a sensitive electronic weighing balance (Salter, 250, England) with sensitivity of 0.01g. The horizontal and Oblong circumference were measured using a thread and well calibrated plastic meter rule respectively. The yolk and albumen heights and diameters were measured (without separating the yolk from the albumen but away from the chalaza) using Venier calipers, respectively. The yolk and albumen height, and diameters were measured respectively. The yolk and albumen indices were calculated by dividing the heights by the average diameters respectively. The shell thickness was obtained using a micrometer screw gauge with sensitivity 0.01mm after removing the egg membrane at three points on the shell. Yolk color was determined using Hoffman La Roche colour fan scale or chart (Esonu *et al*, 2005). The feeding trial lasted 12 weeks. At the end of the feeding trial, three birds per replicate were deprived of feed but not water for 24 hours, weighed, slaughtered and eviscerated for organ weight analysis expressed as percentage of live weight. The carcass was eviscerated by cutting through the vent and the viscera removed. The neck and the shank were cut off to obtain the dressed carcass weight. The kidney, gizzard, heart and liver were weighed, recorded and expressed as percentage of live weight as described by Adeniji (2001).

Statistical Analyses

Data were subjected to analysis of variance (Snedecor and Cochran, 1980). Where significant treatment effects were detected from analysis of variance, means were compared using Duncan's New multiple range tests as outlined (Obi, 1990).

Table 1: Proximate Composition of Raw Sandbox Seed Meal

Components	Percentage
Moisture Content	13.89
Dry Matter	86.11
Crude Protein	23.63
Crude Fibre	19.50
Ether Extract	11.86
Ash	4.86
NFE	26.26

All values expressed on 100% DM

Table 2: Composition of diets fed to laying Hens

Ingredients	Replacement Levels (%)			
	0.0	10.00	15.00	20.00
Maize	50.00	50.00	50.00	50.00
Soyabean meal	20.00	18.00	17.00	16.00
Sandbox meal	0.00	2.00	3.00	4.00
Palm kernel meal	8.00	8.00	8.00	8.00
Wheat offal	7.00	7.00	7.00	7.00
Fish meal (Danish)	5.00	5.00	5.00	5.00
Oyster shell	5.00	5.00	5.00	5.00
Bone Meal	4.00	4.00	4.00	4.00
Vit/Tm premix *	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Methionine (synthetic)	0.25	0.25	0.25	0.25
Chemical Composition:				
Crude protein	17.27	17.64	17.97	18.11
Crude fibre	6.00	6.36	6.55	6.68
Ether Extract	3.88	3.95	3.95	3.98
Calcium	3.80	4.00	4.05	4.05
Phosphorus	1.45	1.48	1.52	1.54
ME (kcal/kg)	2760.90	2785.90	2805.4	2844.15

*To provide the following per kg of feed: Vitamin A 10, 00 iu, Vitamin D₃, 2000 iu, Vitamin E, 5iu; Vitamin k, 2mg; riboflavin, 4.2mg; vitamin B₁₂, 0.01mg; pantothenic acid, 5mg; nicotinic acid, 20mg; folic acid, 0.5mg; choline, 3mg, 56mg; fe, 20mg; cu, 1.0mg Vitamin D₃, 1, 500iu; vitamin k, 2mg; riboflavin, 3mg, panthothenic acid, 6mg, Niacin, 15mg; chlorine chloride, 3mg, vitamin B₁₂, 0.08, Folic acid, 4mg, mn, 8mg; 0.5mg, iodine, 1.0mg; co, 1.2mg; cu, 10mg, fe, 20mg.

RESULTS

The proximate composition of raw sand box seed meal is shown in Table 1, while the nutrient composition of the experimental diets is presented in Table 2. Performance indices of the hens on various substitution levels of soyabean with raw sandbox seed meal are presented in Table 3. There were no significant ($P>0.05$) differences in the performance of the groups on the control and those on the substitution levels in all the parameters measured except in body weight gain. Feed intake, feed conversion ratio hen-day egg production (%), and egg weights of the groups on the partial substitution levels of soyabean meal with raw sandbox meal compared favourably with the control group. Birds on the control diet showed numerical increase which was however not statistically significant ($P>0.05$) except in body weight gain. The organ weights and egg quality characteristics (both external and internal analysis) of the birds on partial substitution levels of soyabean meal

with raw sandbox meal compared favourably with the control group.

DISCUSSION

Raw sandbox seed meal was used to partially substitute soyabean meal in laying hen diets. Generally, the treatment groups compared favourably with the control group. This comparable performance could probably be attributed to the fact that raw *Hura crepitans* seed meals contain essential amino acids at levels that compared favourably with soyabean meal (Esonu et al, 2014; Ozeudu et al, 2015). The nutritive value of a protein is dependent on the extent to which the composition of its essential amino acids fulfills the requirement of the animal being fed Yaakugh et al, 2001; Esonu, et al, 2004, Esonu, et al, 2018). *Hura crepitans* seed also contains oil which enhances the energy density of the diet for normal maintenance and productive functions, it also serves as a source of essential fatty acids as well as carrier of fat soluble vitamins (Esonu et al, 2004 and Ozeudu, 2012).

Table 3: Performance of the laying hens on partial replacement of Soyabean with the raw sandbox seed meal

Parameters	Replacement levels (%)				SEM
	0.00	10.00	15.00	20.00	
Initial body wt (g)	1525.0	1526.0	1521.0	1521.0	5.50
Final body weight (g)	1704.1	1689.0	1683.2	1678.0	8.50
Body weight gain (g)	179.0 ^a	163.0 ^b	162.0 ^b	158.0 ^b	5.30
Feed intake (g/day)	140.08	141.50	139.5	137.1	3.70
Hen-day egg production (%)	86.27	76.72	84.64	75.00	8.39
Feed conversion ratio (g. feed/g. egg)	2.07	2.10	2.12	2.11	0.15
External Egg characteristics					
Average Egg weight (g)	67.77	64.47	65.65	64.94	1.50
Horizontal circumference (cm)	14.23	14.18	14.04	14.06	0.12
Oblong circumference (cm)	16.37	15.95	16.02	16.01	0.15
Internal Egg Characteristics					
Shell thickness (mm)	0.38	0.36	0.36	3.35	0.04
Yolk index	0.41	0.44	0.43	0.40	0.05
Albumen index	0.06	0.06	0.06	0.06	0.00
Yolk colour	4.42	4.54	4.46	4.58	-
Haugh Unit (HU)	77.89	76.78	77.85	75.87	1.68
Internal organ weights:					
Live weight (g)	1675.0	1678.0	1533.0	145.0	1.05
Carcass weight (g)	1550.0	1550.0	1425.0	1225.0	1.55
Dressed weight (g)	1247.0	1224.0	1050.0	1051.0	0.65
Dressing percentage (%)	73.45	72.94	72.55	72.48	1.84
Heart (%)	0.47	0.51	0.45	0.45	0.02
Kidney (%)	0.14	0.14	0.12	0.12	0.05
Liver (%)	1.45	1.50	1.55	1.52	0.01
Gizzard (%)	3.22	3.34	3.35	3.32	0.04

ab: Means along the same row with different superscripts are significantly ($p < 0.05$) different

In addition, *Hura crepitans* seed meal contains adequate crude fibre level, crude fibre activates the intestine and more occurrence of peristaltic movement, more enzyme production resulting in efficient digestion of nutrients. This observation agrees with earlier reports by Cheeke et al, (1983); Kekeocha, (1984); Adeniyi (2001); Esonu et al, (2002); Esonu et al (2004). *Hura crepitans* seed meal contains some essential minerals like sodium (Na), Calcium (Ca), and potassium (K) which are important in the general development and egg production of the birds (Esonu et al, 2014). Organ weights expressed as percentage of the body weight were not affected by the treatments. Organ weights is an index of nutrient retained by the birds. The values recorded for external and internal characteristics of the eggs were in line with that reported for normal fresh eggs (Esonu, et al, 2004; Emenalom, 2010). The intensity of yolk colour slightly increased with increased substitution level though not significant ($P > 0.05$).

This is an indication that raw *Hura crepitans* seed meal is a good pigmenter. Results of this research suggest therefore that raw sandbox seed meal could partially substitute soyabean meal at 20% in laying hen diets.

CONCLUSION

In conclusion, the results of this research suggest therefore that raw undecorted sandbox seed Meal could partially substitute soybean meal at 20% in laying hen diets without adverse effect and no conflict of interest.

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