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SUBSTITUTION VALUE OF COOKED SANDBOX (*Hura Crepitans*) SEED MEAL FOR SOYA BEAN MEAL IN LAYERS DIETS

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Abstract
Mature sandbox *(Hura crepitans)* undecorted seeds were boiled for 1 hour at 100°C, sundried for 3 days and crushed in a hammer mill with a sieve size of 3.36mm to produce cooked undecorted sandbox *(Hura Crepitans)* seed meal. A 12-week feeding trial was carried out to evaluate the substitution value of cooked undecorted sandbox (*Hura Crepitans*) seed meal for soyabean meal in layers diets. Four experimental layers diets were formulated such that cook sandbox seed meal so prepared substituted soybean meal at 0%, 10%, 15% and 20% dietary levels respectively. Two hundred and forty (240) Shika Brown laying hens (already 6 months in lay on deep litter) were divided into four groups of sixty (60) hens each, and randomly assigned to the four treatment diets in a completely randomized design (CRD). Each treatment group was further subdivided into three (3) replicates of twenty (20) 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 (9.00 am and 3:00pm) and weighed. Five eggs from daily collections from each treatment were randomly selected and evaluated daily for external and internal egg characteristics. At the end of the feeding trial, five (5) hens 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. Data Collected were subjected to analysis of variance. Results show there were no significant (P>0.05) differences among the treatment groups in all the parameters measured, except in body weight gain and Haugh unit of the laying hens. Feed intake, feed conversion ratio (g.feed/g.egg), hen-day egg production (%), and egg weights of the groups on the substitution levels compared favourably with the control group. The organ weight analysis and egg quality characteristics (external and internal) of the hens were also comparable with the control group. The results of this experiment suggest therefore, that cooked undecorted sandbox (*Hura Crepitans*) seed meal could partially substitute soybean meal in layers diets at 20% dietary level, however for optimal egg production, 10% dietary substitution level is recommended.

Keywords: Cooked undecorted sandbox seed meal, substitution level, soybean meal, performance, and laying hens

Introduction

Nigeria like many developing countries of the world is faced with the problem of malnutrition particularly in terms of daily protein intake, as the cost of living in these countries rises; this challenge becomes intense (Esonu *et al.,* 2015). Shortage of protein, particularly those of animal origin is prevalent in all parts of Africa where it is estimated that an average of 10g of animal protein is consumed per day, as against the recommended daily intake of 56g (ILCA, 2002; FAO, 2000). With increased human population, the demand for protein sources becomes higher and supply must meet the demand in order to prevent malnutrition, but the stiff competition between man, animal and industries for the available conventional feedstuffs such as maize, soyabean and others (which supply the protein, energy and other nutritional needs of the birds), is basically a challenge in terms of production cost and seasonal availability (Esonu *et al*., 2001). There is an urgent need to replace these costly conventional feed resources with cheap, locally available potential feed resources. One of such potential unconventional feed resource is the seed of sandbox (*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 *Euphorbiacecea* 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 (Yaakugh *et al.,* 2001, Feldkamp, 2006). The tree is estimated to produce 30-50kg seeds annually which are wasted and un-utilized, thus the need to exploit and harness its potentials as poultry feed stuff (Esonu *et a.l,* 2014). Sandbox seed contains high quality protein and oil with a range of 22-37.64% and 43.52-53.81% respectively (Yaakugh *et al.*, 2001; Fowamola and Akindahunsi, 2007; Muhammad *et al.*, 2013). This study was designed to evaluate the substitution value of cooked undecorted sandbox seed meal for soyabean meal in layers diets.

Materials and Methods

The feeding trial was conducted at the Teaching and Research farm of the School of Agriculture and Agricultural Technology (SAAT), Federal University of Technology, Owerri, Imo State, Nigeria. Owerri is in the South-East Agro-ecological zone of Nigeria in the humid tropical area of West Africa. The mean annual rainfall, temperature and relative humidity are 2500mm, 26.5-27.5^{o}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 (Atlas of Imo State, 1984). Matured sandbox seeds used for this research were harvested from Ohaji village in Ohaji/Egbema Local Government Area of Imo State. The seeds were boiled undecorted for one hour at a temperature of 100°C and sundried for three (3) days, crushed thereafter in a hammer mill with a sieve size of 3.36mm to produce cooked sandbox seed meal. Proximate composition of the cooked sandbox seed meal was determined using standard methods (AOAC, 2000) to determine the nutrient composition as presented in Table 1.

Experimental Diets and Birds

Four (4) experimental layers diets were formulated such that cooked sandbox seed meal was included to substitute soyabean meal at 0%, 10%, 15% and 20% dietary levels respectively. Other ingredients were adjusted such that the diets were iso-nitrogenous and nutrient requirements of the laying hens met. The ingredients and chemical composition of the experimental diets are shown in Table 2. Two hundred and forty (240) Shika Brown laying hens (already 6 months in lay on deep litter) were divided into four groups of sixty (60) hens each and randomly assigned to the four treatment diets in a completely randomized design (CRD). Each treatment was sub-divided into three (3) replicates of twenty (20) 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 and internal egg characteristics. The feeding trial lasted 12 weeks. At the end of the feeding trial, five (5) hens per replicate were deprived of feed but not water for 24 hours, weighed, slaughtered and eviscerated for organ weight characteristics expressed as percentage of live weight. Data collected were subjected to analysis of variance (Snedecor and Cochran, 1980). Significant treatment effects were detected from analysis of variance, means were compared using Duncan's New multiple Range Tests as outlined by Obi (1990).

Table 1: Proximate Composition of Cooked Sandbox *(Hura Crepitans*) seed meal (% DM Basis)

Components	Percentage
Moisture Content	17.24
Dry Matter	82.76
Crude Protein	20.13
Crude Fibre	25.00
Ether Extract	4.62
Ash	5.29
Nitrogen Free Extract	27.72

All values expressed on 100% DM

Table 2: Ingredient composition of the experimental diets

	Substitution Levels (%)			
Ingredients	**0.0**	**10.00**	**15.00**	**20.00**
Yellow 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	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
Common salt	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Vit/Tm premix *	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00
Chemical Composition				
Crude protein	17.12	17.60	17.37	17.22
Crude fibre	6.00	6.36	6.55	6.40
Ether Extract	3.88	3.96	3.85	3.84
Calcium	3.20	3.23	3.22	3.22
Phosphorus	1.50	1.54	1.56	1.54
ME (Kcal/kg)	2760.00	2745.00	2735.00	2735.00

***To provide the following per kg of feed: Vitamin A 10, 00 iu, Vitamin D_3, 2000 iu, Vitamin E, 5iu; Vitamin k, 2mg; riboflavin, 4.2mg; vitamin B12, 0.01mg; pantothenic acid, 5mg; nicotinic acid, 20mg; folic acid, o.5mg; choline, 3mg, mg, 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**

Results and Discussion

The proximate composition of cooked undecorted sandbox seed meal is shown on Table 1, while the nutrient composition of the experimental diets is presented on Table 2. Data on the performance, egg quality and organ characteristics of the laying hens on the substitution levels of soyabean meal with cooked sandbox seed meal are presented on Table 3. There were no significant (P>0.05) differences among the groups in all the parameters measured except in body weight gain, hen-day egg production (%) and Haugh Unit of the laying hens. Feed intake, feed conversion ratio (g.feed/g.egg), egg weights of the groups on the substitution levels compared favourably with the control group. The organ weight analysis and egg quality characteristics (both external and internal analysis) of the hens were comparable with the control group. Layers on substitution levels compared favorably with the control group in hen-day egg production (%). This was significantly higher at 10% substitution level.

From the nutrient composition of the experimental diets, it appears that cooked sandbox meal could supply adequate amount of mineral (Ash) required for proper growth, development, blood, egg shell and bone formation and for egg production (Esonu *et al*., 2014; Ozeudu *et al*., 2015). Hens on cooked sandbox seed meal compared very favourably with the hens on the control diet and even better at 10% substitution level. The general favourable and higher performance of the hens on sandbox seed meal over the control at 10% substitution level in terms of hen-day egg production could be probably due to increased availability of nutrients and adequate dietary crude fibre level. Crude fibre activates the intestine and more occurrence of peristaltic movement, more enzyme production resulting in efficient digestion of nutrients (Esonu, *et al.*; 2014). It has been reported that adult birds digest substantial amount of fibre than young chicks (Iheukwumere *et al.*, 2004; Esonu *et al.*, 2014). Feed intake of the hens was inconsistent with increasing substitution levels of cooked sandbox seed meal. It did not follow any pattern. The result on feed intake agrees with earlier studies in this station with broilers (Esonu *et al.*, 2014, Ozeudu *et al.*, 2015). This improved performance could also be because the sandbox seed meal contain amino acids at levels that compared favourably with soyabean seeds and even better in terms of essential amino acid profile (Yaakugh *et al.*; 2001). The nutritive value of protein is dependent on the extent to which the composition of its essential amino acids that fulfilled the requirements of the animal being fed (Esonu *et al.*, 2006; Yaakugh *et al.,* 2001; Ozeudu *et al.*, 2015). In addition, sandbox seed meal contains oil which enhances the energy density of the diet for normal maintenance and productive functions, it also serve as a source of essential fatty acids and carrier of the fat-

soluble vitamins (Esonu *et al.*, 2004). This probably may have also enhanced the general comparable and improved performance of the hens on the test material at 10% substitution level over the control group. This result agrees with earlier reports with broilers in this station (Esonu *et al.*, 2014; Ozeudu *et al.*, 2015). 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, 2008). The intensity of yolk colour did not increase with increased substitution level of cooked sandbox seed meal. This is an indication that the material is a poor pigmenter.

Table 3: **Performance of the experimental laying hens on the substitution value of cooked sandbox seed meal for soyabean meal**

	Substitution levels (%)				
Parameters	**0.00**	**10.00**	**15.00**	**20.00**	**SEM**
Initial body weight(g)	1525.00	1523.00	1523.00	1523.00	5.50
Final body weight(g)	1704.00	1700.00	1708.00	1708.00	30.90
Body weight gain (g)	179.00[a]	177.00[a]	185.00[b]	185.00[b]	18.00
Feed intake (g/day)	140.08	141.59	140.18	139.80	25.85
Hen-day egg production (%)	86.27[b]	88.82[a]	86.09[b]	84.18[b]	5.39
Average egg weight (g)	67.77	67.32	68.12	67.56	0.61
Feed conversion ratio (g. feed/g. egg)	2.07	2.10	2.08	2.08	0.12
Haugh Unit (HU)	77.89[a]	71.01[a]	77.78[a]	80.07[b]	1.68
Shell thickness (mm)	0.38	0.39	0.39	3.39	0.04
Yolk index	0.41	0.40	0.43	0.43	0.06
Albumen index	0.90	0.85	0.91	0.91	0.05
Horizontal circumference	14.23	14.12	14.30	14.30	0.12
Oblong circumference (cm)	16.37	16.19	16.22	16.24	0.04
Yolk colour	4.42	4.44	4.41	4.50	-
Internal organ analysis					
Live weight (g)	1675.0	1655.0	1680.0	1665.0	0.75
Carcass weight (g)	1550.0	1550.0	1575.0	1550.0	1.55
Dressing percentage (%)	76.45	76.24	75.06	74.73	1.41
Heart (%)	0.47	0.50	0.45	0.55	0.003
Kidney (%)	0.14	0.14	0.15	0.15	0.04
Liver (%)	1.51	1.54	1.56	1.52	0.001
Gizzard (%)	3.34	3.35	3.35	3.35	0.20

ab:- means within the same row with different superscript are significantly different (p>0.05)

Conclusion

The results of this experiment suggest therefore that cooked sandbox (*Hura Crepitans)* seed meal could partially substitute soyabean meal in layers diets at 20% dietary level, however for optimal egg production, 10% dietary substitution level is recommended.

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