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Performance of Broilers Fed Silk Cotton Seed (*Ceiba petandra*) Based Diets

***Ari, M. M[1]., Barde, R . E[1].,Ogah, M.D. [1], Yakubu, A[2] and Aya, V.E[1]**

[1]Department of Animal Science, College of Agriculture,
PMB 33 Lafia, Nasarawa State

[2]Faculty of Agriculture, Nasarawa State University Keffi

*Corresponding author: +234 803 6253270 arimaikano@yahoo.com

Abstract

The utilization of silk cotton seed (*Ceiba patandra*) as a substitute for full fat soyabeans was evaluated using 120 Anak broiler chickens during 8 week feeding trails in which silk cotton seed (toasted, TSCS and untoasted, USCS) was used to replace soyabean at 0%(T1), 50%TSC (T2), 50%USCS (T3), 100%TSCS (T4) and 100% USCS(T5).Data were collected on average feed consumption, body weight gain (BWG), feed conversion ratio (FCR) and performance index. The results obtained showed treatment effect on feed intake and weight gain was significant ($P<0.05$). However, the highest feed intake and weight gain (880.68 g and, 429.65 g) respectively was recorded for T1 (control). T 2 showed the best replacement potentials for soyabeans in terms of feed intake (676.16 g) and BWG (449.56 g). Similarly, mean feed conversion ratio and performance index were significantly ($P<0.05$) different between treatment groups. From the results obtained in this study, it could be concluded that 50% replacement of soyabeans with toasted silk cotton seed (TSCS) is a desirable substitute for soyabean in the diets of broilers.

Keywords: Broilers, Feed Substitution, Performance index , Silk Cotton Seed (*Ceiba patandra*)

INTRODUCTION

Oil seeds account for the largest cost item by volume in any poultry feed production enterprises (Refstie, *et a*l. 1999). Therefore the search for alternative replacement for the major oil seeds in poultry nutrition will continue to attract attention from all stakeholders. These alternative replacements must however be nutritionally rich, have cost / availability advantages and should be less competitive than the major oilseeds like soyabean and groundnut.

The protein content of silk cotton meal is of good quality but low in cystine and methionine (Morgan, 1990), *Ceiba pentandra* and also contains essential minerals and trace elements that promote well being (Obiajunwa *et al.*, 2005) and fatty acids glycosides, saponins and steroids (Friday *et al.*, 2011 and Sarkiyayi et al., 2009). Silk cotton seed however contain 0.3 to 20g/kgDM of a yellow pigment known as gossypol that is particularly toxic to animals. The general symptoms associated with this anti nutritional factor (ANF) in poultry are depressed appetite, loss of weight, growth depression in chicks and discoloration of the egg yolk in layers (Narahari and Asha - Rajini ,2003), while studies have also shown that saponnin although non toxic can generate adverse physiological responses in animals that consume them (Iniaghe, 2009).

Other ANFs and bioactive compounds present in silk cotton seed *(kapok)* as reported (Diarra, 2010, Edeoga *et al*., 2006, Akindahunsi and Salawu, 2005, Narahari and Asha-Rajini ,2003) includes tannins, tyrosines and fatty acids with cyclopropene rings. Some of these anti-nutrient content (cyanogenic glycoside, trypsin inhibitors, hemagglutinin inhibitor, phytate and oxalate) in silk cotton seed are of low values (Friday, 2011) which implies that the plant is safe for human and animal utilization. This is corroborated by the report of Sarkiyayi *et al*. (2009) on the acute and chronic toxicity profile studies of *C. pentandra* which showed that in all the parameters studied (serum bilirubin, Packed Cell Volume (PCV) and creatinine) were within physiological acceptable range.
Even though Narahari and Asha- Rajini (2003) reported the good replacement potentials of the silk cotton seed cake when *kapok* seed replaced sunflower meals (SFM) in broiler feeds, the need for adequate processing to reduce the antinutritional factors in plants used as human foods and animal feeds was reviewed by Maker and Becker.(1999) and Soetan and Oyewole (2009). This work was therefore aimed at assessing the replacement potentials of toasted and untoasted silk cotton seed in soya beans based broiler diet by evaluating performance indicators for broilers.

MATERIALS AND METHODS

Seeds collection and Processing:

Silk cotton seeds *(Ceiba petandra)* were obtained from a local market in Kanke Local Government Area of Plateau State, Nigeria. The collected seeds were cleaned by winnowing and hand picking of stones and debris.
The cleaned Silk cotton seeds *(Ceiba petandra)* were toasted at an approximate temperature of 100 ^{0}C for 30 minutes according to the methods described by Ari (2006). The dried silk cotton seeds were spread on a clean floor to cool before grinding. The chemical composition of the toasted and untoasted silk cotton seed samples were analyzed according to A.O.A.C (2000) method. This forms the basis of experimental feeds formulation.

EXPERIMENTAL PROCEDURE

This study was conducted at the teaching and Research unit of livestock complex of College of Agriculture, Lafia using 120 day –old Anak broiler chicks .The experimental birds were randomly divided into five (5) treatment groups that were replicated twice. Treatment 1 which represents the control group were fed 100% soyabean cake (SBC) based diets , while treatments 2 and 3 were fed 50% replacements of SBC with 50 % of untoasted (USCS) and toasted silk cotton seeds (TSCS), Treatments 4 and 5 however represents 100% untoasted and toasted silk cotton seed *(Ceiba petandra)* replacement of soyabeans in the broiler diets. The experimental diets were formulated to be *isocaloric*

and *isonitrogenous* using a least cost method of feed formulation software *feedwin*. The formulated and the determined composition of experimental diets are presented in Tables 2 and 3 respectively. All management activities were uniformly carried out for all treatment groups and experimental birds were fed *ad libitum* throughout the duration of the experiment.

DATA COLLECTION

The weekly records of average feed consumption, body weight gain, feed gain ratio, survival percentage and weekly performance index for each for each treatment group were obtained during the eight week feeding trial. All data collected were subjected to the analysis of variance (ANOVA) using SPSS for windows 16.0. Duncan's multiple range tests was used to separate means which were significantly different.

RESULTS AND DISCUSSION

The chemical composition of the toasted and untoasted silk cotton seed are presented in Table 1. The results indicated higher Crude Protein (CP), Crude Fibre (CF), ether Extract (EE) and Nitrogen Free Extract (NFE) values for untoasted silk cotton seeds while the ash and mineral content of the seed was improved by toasting. This indicates that the nutrient content of the silk cotton seed is affected by heat treatment. The CP values of both the toasted and the untoasted silk cotton seed however differs with the values (25%) reported by Komolafe *et al.* (1981) but are consistent with of 30% range reported elsewhere (Narahari and Asha -Rajini,2003).

The differences in the performance parameters of the experimental birds fed different replacement levels of soyabeans with toasted and untoasted silk cotton seed are presented in Table 4. The average BWG as affected by treatment was significant ($P<0.05$) at the starter phase with treatments 1 (574.05 g) and 2 (444.22 g) having the best values while the lowest value was recorded in treatment 4 (202.71 g). Similar trend was also observed at the finisher phase for the feed intake with values ranging from 517.24 g for treatment 4 to 880.68 g for treatment 1. A significant ($P<0.05$) difference was recorded for Feed Conversion Ratio (FCR) with treatment 4 having the lowest values (1.06) while treatments 1(1.47) and 5 (1.53) had the highest FCR values at the starter phase. The trend in the finisher phase had treatment 1 (2.05) and treatment 2 (1.93) having the highest FCR values followed by,treatment 3 (1.92)while treatments 4 and 5 had the lowest (1.90). However treatment effect on the survival percentage among all treatment groups at the starter phase was not significant. The performance index was nevertheless significantly ($P<0.05$) different among treatment groups at the starter phase with treatments 1 (185.89) and 5 (115.17) having the highest and lowest values

respectively while in the finisher phase treatments 1(203.32) and treatment 2 (166.38) had higher performance index values and treatment 4(126.27) was lowest.

There were significant ($P<0.05$) differences in all the parameters measured at the finisher phase except in the FCR. The best averages were consistently recorded for treatment 1 having the best, followed by treatment 2 for most of the parameters measured

The trend of increase in weight gain and feed intake are in the order of usage of processed silk cotton seed in substituting soyabeans in the experimental diet. These results have shown that the efficiency of utilization of oil seeds is improved by removing ANFs (Obioha, 1992; Caine *et al.*, 1998; Maker and Becker, 1999; Narahari and Asha Rajini, 2003; Singh, 2008, and Dairra *et al.*, 2010) in the inclusion of silk cotton seed which is in agreement with Komolafe *et al* (1981). The low feed intake in treatments with USCS can be accounted for by the adverse physiological responses in animals that consume them which was similarly observed by Iniaghe, (2009). The low mortality rate observed in the study is supported by Friday et al (2011) and Sarkiyayi *et al*. (2009) and therefore an indication of the potentials of this feed material in the diet of broilers. This is also an encouraging factor for the production of this plant, as an added value will be derived from both lint production for the textile industry, medicinal and seed processing for livestock feed industry.

The combination of soyabeans and silk cotton seed in poultry feeds will bring about a balance in and nutrient availability. Therefore, 50% replacement of soyabeans with toasted silk cotton seed is recommended in broiler feeds.

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TABLE 1: Chemical Composition of Toasted and Untoasted Silk Cotton Seed *(Ceiba Petandra)(g* / 100 DM)

Nutrients	UNTOASTED	TOASTED
Moisture	7.10	3.99
Crude protein	31.97	31.30
Crude Fibre	23.41	17.44
Lipids (FAT)	8.77	25.69
Total Ash	5.54	5.62
Nitrogen free extract	30.31	19.95
Calcium	0.36	0.43
Phosphorus	0.54	0.68
Silica	34.46	45.59

TABLE 2: Gross Composition of the Experimental Diets

INGREDIENTS	**0%**	**50%(UT)**	**50%(T)**	**100%(UT)**	**100%(T)**
Bone meal	2.55	2.55	12.5	4.05	3.5
Cassava	12.50	12.50	14.59	9.55	11.55
DL methione	0.15	0.15	0.15	0.20	0.20
Fish meal	3.25	4.25	4.66	3.70	5.00
Lysine (HCL)	0.10	0.10	0.10	0.20	0.20
Limostone	0.75	0.75	0.87	0.25	1.25
Maize	18.90	18.90	14.50	18.5	9.05
Maize bran	5.50	5.50	5.50	9.55	13.00
Rice bran	0.55	0.55	4.00	0.50	9.55
Salt	0.25	0.25	0.25	0.25	0.25
Sorghum	18.25	18.25	18.25	17.50	13.00
Palm oil	2.00	1.50	-	1.50	-
Soyabeans meal	35.00	17.50	17.50	-	-
USCS	-	17.00	-	34.00	-
TSCS	-	-	16.63	-	33.25
*Broiler premix	0.25	0.25	0.25	0.25	0.25
****Calculated**					
Energy(Keal)	2871	2882	2846	2895	2845
CP(%)	22.82	21.30	2133	19.69	19.55
Price /KG feed (N)	43.2	39.63	37.55	35.09	32.26

*Premix to provide the following per KG of diet: vit A. 10.000 IU: Vit D.2000iu; Vit 2.24mg;riboflavin,5.5mg; pantotenic acid. 10mg; nicotinic 2.5mg. choline.350mg; folic acid, 2mg; mangense. 56mg; 10mg.50mg; cobalt. 1.25mg **Feedwin Soft ware

Table 3: Chemical Composition of Experimental Diets/100g Dry matter

	Starter phase					Finisher phase				
Nutrients	1	2	3	4	5	1	2	3	4	5
Dry Matter (%)	92.31	90.36	91.35	89.64	91.21	92.53	92.17	93.18	91.43	93.04
Crude Protein (%)	21.93	20.56	21.60	22.32	21.67	20.64	20.15	21.17	21.87	21.24
Crude Fibre (%)	7.42	7.64	7.49	9.02	7.92	7.51	8.40	8.24	9.92	8.71
Ether Extract (%)	13.12	12.83	13.01	15.58	13.68	12.34	11.42	11.58	13.87	12.18
NFE (%)	33.62	32.3	32.62	24.77	30.93	34.13	30.36	30.66	23.28	29.07
Total ash (%)	16.22	17.03	16.63	17.95	17.01	16.47	16.52	16.13	17.41	16.50
Calcium (%)	1.68	1.58	1.63	1.96	1.72	1.71	1.73	1.79	2.15	1.89
Phosphorous (%)	1.3	1.32	1.31	1.57	1.38	1.32	1.43	1.41	1.70	1.49
Energy*(Kcal/KgME)	3318.75	3188.35	3258.15	3224.235	3258.034	3216.075	2972.21	3038.676	2996.365	3035.667

* Calculated using the method reported by Paul and Southgate (1978)

TABLE 4: Performance of Broilers Fed Silk Cotton Seed based Diets

Treatment	Initial Body Weight gain (g)	Average Body weight (g)	Feed intake (g)	Average weight Gain	FCR	Survival (%)	Performance Index
Starter Phase							
1	46.09 NS	574.05a	410.41a	278.31a	1.47a	98.50 NS	185.89a
2	45.79 NS	444.22b	278.98b	211.84b	1.32ab	92.50 NS	156.50ab
3	45.07 NS	267.29c	228.93c	198.69b	1.15b	95.99 NS	166.12ab
4	43.48 NS	202.71d	205.12c	194.21b	1.06b	91.08 NS	167.97ab
5	44.48 NS	236.39cd	284.91b	188.81b	1.53a	91.65 NS	115.17b
SEM	±0.46	±47.41	±23.86	±11.75	±0.07	±1.28	±9.48
Finisher Phase							
1	573.00a	2127.75a	880.68a	429.65a	2.05NS	97.00a	203.32a
2	458.72b	1660.81ab	676.16b	449.56b	1.93 NS	90.00b	166.38ab
3	267.29c	1081.39ab	567.08c	296.19c	1.92 NS	88.73bc	137.82bc
4	206.94d	1015.53ab	517.24c	272.40c	1.90 NS	88.18c	126.27c
5	224.89d	1097.71ab	594.25bc	313.82bc	1.90 NS	88.50c	147.14bc
SEM	±48.24	±148.97	±43.28	±18.90	±0.03	±1.19	±9.88

abc *means in the same column with the same superscript are not significantly (P>0.05) different*
SEM *Pooled Standard Error of Mean*
NS *Not Significant*

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