Nig. J. Anim. Prod. 2017, 44(5): 162 - 166
Nigerian Journal of Animal Production

Effect of replacing maize with raw *Chrysophyllum albidum* seed kernels on performance of broiler chicken

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Abstract

Maize most often, constitutes the highest proportion of ingredients in diet formulation of any poultry ration and this high inclusion rate translates to high cost of feed because of seasonality in its production and competition for it by man. Thus, an experiment was conducted using 210 unsexed one week old Marshall broiler chicks with an average initial weight of 99.38g to determine the effect of replacing maize with graded levels of raw Chrysophyllum albidum kernel meal (RCKM) on the performance of broiler chickens. The chicks were assigned into seven dietary treatments of 0, 5, 10, 15, 20, 25 and 30% graded levels of RCKM for replacing maize in the diets of the birds. The dietary treatments contained three replicates with 10 chicks per replicate. The proximate composition and phytochemical contents (saponins, phytate, tannins, oxalate, flavonoids, terpenoids and total phenolics) of the RCKM were determined using the procedures of the AOAC (1990) and Sofowora (1993), respectively. The birds were given feed and water ad-lib and weighed weekly. Routine vaccinations and medications were carried out as at when due. In the course of the experiment, data were collected on the initial weight, feed intake, daily weight gain feed conversion ratio (FCR), mortality rate, final live weights and analysed in a completely randomized design. The proximate composition of the RCKM is shown to contain valuable nutrients (high energy, low protein and appreciable mineral contents). The phytochemical content of the C. albidum revealed that, it contains very high amount of phytate, tannins, flavonoids and total phenolics. Results obtained on the performance characteristics revealed that, there was a very highly significant ($p<0.001$) decrease in the final live weights, average daily weight gains, feed intake values as the dietary inclusion of the RCKM increased in the diets of the birds. The values obtained for the final live weights were 1,910.16g, 1,255g, 885.00g, 479.24g, 474.11g, 395.00g and 388.83g for treatments 1, 2, 3, 4, 5, 6 and 7 respectively. The average daily weight gains were 32.34g, 20.66g, 14.04g, 6.78g, 6.69g, 5.29g and 5.15g, the feed intake values were 116.87g, 99.37g, 91.32g, 71.40g, 69.90g, 68.36g, 65.23g, respectively for treatments 1, 2, 3, 4, 5, 6 and 7 respectively. This was accompanied by poor feed conversion ratios and high cost per kg weight gains. In conclusion, though Chrysophyllum albidum kernel meal has potentials for animal feeding due to its high energy levels but there is the need to adequately detoxify the antinutritional factors in the kernels before inclusion in the broilers diet.

Keywords: Maize grain, Raw *Chrysophyllum albidum* kernel meal, Performance of broiler chicken

Introduction

Maize most often, constitutes the highest proportion of ingredients in diet formulation of any poultry ration and this high inclusion rate translates to high cost of feed because of seasonality in its production and competition for it by man (Agbede *et al.* 2002). Preston (1995) reported that one of the major challenges to livestock industry in the tropics is providing alternative feed

resources for monogastrics. Shittu *et al*. (2006) stated that although some alternative feed resources have been discovered to be useful but that there is need to have adequate knowledge of them and their composition. One of the potential alternative feedstuffs is Star apple seed. Star apple, *Chrysophyllum albidum* is a tropical tree of the family Sapotaceae. It has numerous common names in localities where found. In Nigeria, *Chrysophyllum albidum* is popularly known as *Agbalumo, Agwaluma, Udara* among the Yorubas, Hausas, and Ibos respectively. Though naturally, an indigenous wild fruit tree, its enormous potential for plantation establishment has earned its occurrence in Nigeria, Uganda, Niger Republic, Cameroon, Ivory Coast (Adewusi and Bada, 1997). Like other plants in nature, *Chrysophyllum albidum* is known to have antinutritional factors that diminish the nutrients bioavailability if present at high concentrations (Ojako and Igwe, 2008). The fruits are harvested and consumed by man while the seeds generated in tons are discarded and could be used as a cheap alternative nutrients source for animal feeding. There seems to be no reports using star apple seed kernels in broiler nutrition. The study therefore was designed to aim at determining the optimum level at which the raw star apple seed kernels could replace maize in the diets of poultry.

Materials and Methods

The experiment was carried out at the Teaching and Research Farm of Landmark University, Omu-Aran, Kwara State. Two hundred and ten one-week old unsexed Marshall broiler chicks obtained from Zartech farms at Ibadan, Oyo State, Nigeria were used for the study. The chicks were assigned to seven dietary treatments of 0, 5, 10, 15, 20, 25 and 30% graded levels of RCKM for replacing maize in the diets of the birds in a Completely Randomized Design. The fruits of *C. albidum* for this study were collected from the various star apple plantations in Osun state, Nigeria. The seeds were obtained from the fruits and thoroughly washed. They were further dehulled to obtain the kernels. All the birds were raised under similar management practices and weighed weekly. Routine vaccinations and medications were carried out as at when due. In the course of the experiment, data were collected on the following performance characteristics: feed consumption, daily weight gain, growth rate, feed conversion ratio, mortality rate. **Data collected on the response criteria were subjected to analysis of variance according to the completely randomized design model.** Differences between treatment means were separated using the Duncan's multiple range test. The composition of the experimental diet, proximate composition and the phytochemical analysis of the RCKM are presented on Tables 1, 2 and 3 respectively. Proximate composition of the raw kernel meal was conducted following the procedures of AOAC (1990). Quantification of the phytochemicals was carried out using the methods described by Sofowora (1993). The gross energy was determined by the formula method stated by Carpenter and Clegg (1956).

Results

Table 4 presents the result on the performance characteristic of the broilers fed the raw *C. albidum* kernel meal. The parameters were all significantly ($p<0.001$) affected except for the percent mortality that was not significantly ($p>0.05$) affected. The final live weights and the average daily weight gains decreased with a corresponding increase in the dietary

Table 1: Composition of the Experimental diets for Broiler finisher (Kg/100Kg)

	D	i	e	t	s		
	1	2	3	4	5	6	7
% RCKM	0	5	10	15	20	25	30
Maize	63.91	60.71	57.52	54.32	51.13	47.93	44.74
RCKM	0.00	3.20	6.39	9.59	12.78	15.98	19.17
Soya bean meal	30.19	30.19	30.19	30.19	30.19	30.19	30.19
Fish meal	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Lysine	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Methionine	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Bone meal	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Limestone	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Salt	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Vitamin.premix	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Table 2: Proximate Composition of Star Apple Kernel Meal

Parameters	**%**
Dry matter	91.38
Crude protein	8.71
Ether extract	3.10
Ash	4.79
Crude fibre	7.42
Soluble carbohydrate	67.36
Gross energy (Kcal/kg)	2,939

Table 3: Phytochemical Analysis of Star Apple Kernel Meal

Parameters	**mg/kg**
Saponin	12.15
Phytate	1,308.70
Tannins	1,037.47
Oxalate	0.8032
Flavonoid	26,539.66
Total phenolics	7,911.11
Terpenoids	1.367

Table 4: Performance indices of Broiler birds Fed Raw *C. albidum* Kernel Meal

	D	i	e	t	s			
	1	2	3	4	5	6	7	SEM
% RCKM	0	5	10	15	20	25	30	
Initial lvwt	99.04	99.04	99.04	99.52	99.52	100.47	99.04	1.09
Final lvwt	1910.16^{a}	1255.72^{b}	885.00^{c}	479.24^{d}	474.11^{d}	395.00^{e}	388.83^{d}	4.99
Daily wtg	32.34^{a}	20.66^{b}	14.04^{c}	6.78^{d}	6.69^{d}	5.29^{d}	5.15^{d}	0.65
Feed intake	116.87^{a}	99.37^{b}	91.32^{b}	71.40^{c}	69.90^{c}	68.36^{c}	65.23^{c}	1.45
FCR	3.61^{d}	4.84^{d}	6.63^{c}	10.53^{b}	10.32^{b}	12.84^{a}	13.23^{a}	0.54
Cost/kg/wg	382.32^{d}	505.11^{d}	680.54^{c}	1063.80^{b}	1025.81^{b}	1254.8^{a}	1271.8^{a}	5.42
Feed cost	106.00	104.30	102.70	101.10	99.40	97.70	96.10	
%Mortality	0.00	0.00	0.33	0.00	0.33	0.33	0.00	0.35

SEM= Standard error of mean; ^{a,b,c,d}Means with different superscript along the same rows are significant; Initial lvwt = Initial live weight(g/bird); Final lvwt = Final live weights (g/bird); Daily wtg = Daily weight gains (g/bird/day); Fee d intake (g/bird/day;FCR=Feed conversion ratio; Cost/kg/wg = Cost per kg weight gain (₦); Feed cost= Feedcost/kg (₦).

inclusion of the RCKM for the replacement of maize as energy source. There was a linear decrease in the feed intake values per day as the level of the RCKM increased in the diet. There was an increased poor feed conversion ratio as the RCKM increased in the diets. The results of the cost per kg weight gains followed the same trend with the feed conversion ratios.

Discussion

The observed significant ($p<0.05$) decrease in the final live weights of the birds is supported by the findings of Ojako and Igwe (2008) that antinutritional factors (ANFs) like saponins, cyanogenic glycoside, oxalate, phytate, tannins and these phytotoxins are found to diminish the nutrients bioavailability if present at high concentrations. This is also in line with the findings of Roeder (1995) that phytochemicals causes reduced growth rate. The reduced average daily weight gains observed in treatments 2-7 is in line with the findings of Su and Guo (1986) that saponins reduce uptake of nutrients (carbohydrates, proteins), hence reduces growth rate and feed efficiency in monogastric animals. The decreased feed intake observed corroborates the findings of Tapiers *et al*. (2002) who reported that tannins have astringent properties that affect palatability, reduce feed intake and consequently body growth. The poor FCR recorded in treatments 2-7 compared with the reference diet is due to ANFs present in the RCKM. This assersion is in line with the reports of Elkin *et al*. (1990) that tannins adversely affect feed intake and feed efficiency in broiler chickens. The soluble carbohydrate of 67.36% (Table 2) in the kernels is within the range of 44.8- 69.6% reported for maize by Sule *et al*. (2014) affirming its suitability as a good novel energy source for animal feeding.

Conclusion

The study showed that deleterious effects were expressed in the birds beyond 5% inclusion level of the raw *Chrysophyllum albidum* kernel meal in their diets necessitating the need to process the kernels before inclusion in the diet of the birds.

Acknowledgement

We thank the management of Landmark University for providing the facilities used for this study.

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Received: 18th September, 2017
Accepted: 30th November, 2017