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Effect of feeding fermented/non-fermented kapok (*Ceiba pentandra*) seed cake as replacements for groundnut cake on performance and haematological profile of broiler finisher chickens

Authors:
Oyebode DO[1], Ogundipe SO[1], Olugbemi TS[1] and Sekoni AA[2]

Institution:
1. Department of Animal Science, Ahmadu Bello University, Zaria, Nigeria.

2. National Animal Production Research Institute, Ahmadu Bello University, Zaria.

Corresponding author:
Oyebode DO

ABSTRACT:

An experiment was conducted to evaluate performance of broiler chickens fed Non-Fermented (NFKSC) and Fermented (FKSC) Kapok Seed Cake as replacements for groundnut cake (GNC) in broiler finisher diets. A total of 225 day old broiler chicks were randomly allotted to five dietary treatments in a completely randomized design with 15 birds per replicate. Graded levels of Kapok Seed Cake (0, 10% NFKSC, 10% FKSC, 15% NFKSC and 15% FKSC) were fed at the finisher phase. The following average final weights were recorded (2342, 2210, 2339, 2131 and 2307 kg) for (0% KSC, 10% NFKSC, 10% FKSC, 15% NFKSC and 15% FKSC diets), respectively. Haemoglobin and Total protein were not affected at 10% FKSC level but decreased significantly at higher levels. Packed cell volume decreased with increase in the level of FKSC. Results showed that fermentation improved utilization of FKSC resulting in increased final weight and weight gain up to 10% dietary inclusion. No significant negative effects on haemoglobin, total protein and packed cell volume up to 10% FKSC were observed. It can be concluded that dietary level of up to 10% FKSC can be incorporated into practical broiler finisher rations without deleterious effects on the performance and haematological profile of broiler finisher chickens.

Keywords:
Kapok seed cake, Broiler chicken and Haematological profile.

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INTRODUCTION

The level of animal protein consumption in most developing countries of the world including Nigeria is very low. Low intake can be linked to high cost of the products arising mainly from high cost of production inputs, especially feed (Abeke *et al*., 2007; Bawa *et al*., 2003). In recent times, there has been a wide gap between production and supply of animal protein to feed the growing population of over 140 million Nigerians (NPC, 2006) resulting in low per capita consumption of animal protein (Christopher *et al*., 1997).

Competition between man and livestock for conventional feed ingredients has necessitated the search for alternative, non-conventional feed ingredients that would suitably replace the conventional ones used in formulating poultry diets (Dafwang *et al*., 2001). The primary objective of utilizing these traditional feed components is to diminish the cost of production and in this way making it feasible for a normal Nigerian to have the capacity to manage the cost of animal protein in their feed (Ojebiyi *et al*., 2006; Olabanji *et al*., 2009). However, the use of some non-conventional feedstuffs could lead to poor nutrition arising from the effects of anti-nutrients, poor nutrient qualities and nutrient-imbalances.

MATERIALS AND METHODS

Mechanically extracted KSC was purchased from an oil-extraction and refining mill based in Kano (Sharada oil mills Co-operative). The study was carried out at the Teaching and Research Farm, Department of Animal Science, Ahmadu Bello University, Samaru-Zaria, located within the Northern Guinea Savannah zone.

Fermentation of kapok seed cake sample

Kapok seed cake for this study was subjected to anaerobic fermentation after being moistened with hot water and exposed to the open air for about three hours after which it was covered up in an air tight container to exclude air as much as possible following the procedure outlined by Hesseltine (1983). Four batches of KSC were moistened with water as described above and left under atmospheric condition for about an hour after which they were packaged in four air-tight plastic containers and allowed to ferment for 48, 72, 96 and 120 hours. Fermented materials were sundried for three days to reduce their moisture contents. Samples were taken from each batch and subjected to laboratory analysis at the National Animal Production Research Institute, Shika- Zaria, for proximate compositions and tannin levels. The period of fermentation that resulted in the least tannin level and also maintained the nutritional value of the KSC was chosen and used for the second phase of the experiment. The 96 hours fermentation resulted in the least tannin level and was chosen for the study. At the end of the fermentation period, the fermented samples were sun-dried for three days to reduce the moisture content for storage and for subsequent ration formulations.

Experimental design and management of birds at the finisher phase (5 to 8 weeks)

A total of 225 broiler finisher birds were used for this experiment. The birds were allotted to five dietary treatments. The diets were formulated with Fermented Kapok Seed Cake (FKSC) and Non-Fermented Kapok Seed Cake (NFKSC) inclusion at the levels of 0, 10 and 15% as replacements for groundnut cake (Table 1). Every dietary treatment was replicated three times with fourteen birds for each repeat in a completely randomized design. The diets were planned as per the NRC (1991) recommendations.

Haematological evaluation

Towards the end of the feeding trial, six examples of birds were chosen from every treatment (two birds for each replicate) and 2 ml of blood sample was taken from each through the wing vein in a collection bottles containing Ethylene Di-amine Tetra

Table 1. Composition of broiler finisher diets for fermented or non-fermented KSC

S. No	Ingredient (%)	KSC (%)				
1		**0**	**10NF**	**10F**	**15NF**	**15F**
2	Maize	56.05	54.00	54.00	53.05	53.05
3	Groundnut cake	20.00	10.00	10.00	5.00	5.00
4	KSC (fermented)	-	10.00	10.00	15.00	15.00
5	Soya cake	14.00	14.00	14.00	14.00	14.00
6	Fishmeal	4.00	4.20	4.20	4.30	4.30
7	Bone ash	3.00	3.00	3.00	3.00	3.00
8	Limestone	1.00	1.00	1.00	1.00	1.00
9	*Vitamin/Mineral premix	0.25	0.25	0.25	0.25	0.25
10	Methionine	0.20	0.20	0.20	0.20	0.20
11	Lysine	0.20	0.20	0.20	0.20	0.20
12	Table salt	0.30	0.30	0.30	0.30	0.30
13	Palm oil	1.00	2.85	2.85	3.70	3.70
	TOTAL	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
S. No	**Calculated analysis**					
1	ME (Kcal/kg)	3000	3000	3000	3000	3000
2	Crude protein (%)	21.00	21.00	21.00	21.00	21.00
3	Crude fibre (%)	3.81	4.66	5.51	6.36	7.21
4	Ether extract (%)	4.40	4.45	4.53	4.58	4.61
5	Calcium (%)	1.40	1.39	1.37	1.35	1.34
6	Avail phosphorus (%)	0.65	0.61	0.58	0.56	0.53
7	Methionine + Cysteine (%)	0.86	0.85	0.83	0.82	0.80
8	Lysine (%)	1.12	1.10	1.09	1.08	1.07
9	Cost/Kg diet (N)	78.14	77.58	77.05	76.65	76.16

*Vitamin/Mineral Premix is composed of the following per kg diet: Vitamin A 8000 IU; Vitamin D_3 1600 IU; Vitamin E 5.0 IU; Vitamin K 0.2mg; Thiamine 0.5mg; Riboflavin 4mg; Pyridoxine 0.015mg; Niacin 0.015mg; B_{12} 0.01mg; Pantothenic acid 0.5mg; Folic acid 0.5mg; Biotin 0.02mg; Choline chloride 0.02mg; Anti-oxidant 0.125g and Minerals (Mn, Zn, Fe, Cu, I, Co) 0.156g.
KSC= Kapok Seed Cake; **NF=** Non-Fermented; **F=** Fermented

Acetic Acid (EDTA) and later analyzed for Packed Cell Volume (PCV), Hemoglobin level (HB) and Total Protein (TP) as indicated by the strategies depicted by Lamb (1991) at the hematological laboratory of Veterinary Teaching Hospital, Ahmadu Bello University, Zaria.

Statistical analysis

Data obtained from all the experiments were subjected to the analysis of variance using the general linear model procedure of SAS (1993). Significant differences in means were separated using Duncan's Multiple Range Test according to the procedures described by Steel and Torrie (1960).

RESULTS AND DISCUSSION

The final live weights and average weight gain of birds fed with the 0 KSC and 10% fermented KSC diets were similar and their values were significantly higher than those of birds fed with 10% non-fermented KSC diet ($P < 0.05$). The values were also significantly ($P < 0.05$) better than those of birds fed fermented or non-fermented 15% KSC diets. Result for feed intake showed that birds fed the 10% fermented KSC diet had significantly ($P < 0.05$) highest feed intake, which was

Table 2. Performance of broiler finisher chickens fed diets containing fermented or non-fermented KSC

S. No	Parameters	KSC (%)					
1		**0**	**10NF**	**10F**	**15NF**	**15F**	**SEM**
2	Av. Initial Wt (g/bird)	1114.00	1113.95	1114.00	1113.98	1114.01	0.39
3	Av. Final Wt (g/bird)	2342.33^{a}	2210.33^{c}	2339.00^{a}	2130.67^{d}	2307.33^{b}	3.55
4	Av. Wt. gain (g/bird)	1228.33^{a}	1096.38^{c}	1225.00^{a}	1016.69^{d}	1193.32^{b}	8.80
5	Av. Feed Intk (g/bird)	2901.99^{c}	2862.67^{d}	2933.33^{a}	2757.71^{e}	2917.70^{b}	12.35
6	FCR	2.36^{a}	2.61^{c}	2.40^{ab}	2.71^{d}	2.45^{b}	0.05
7	Mortality (%)	0.00^{a}	3.33^{c}	0.67^{b}	3.67^{c}	2.00^{bc}	1.02
8	Cost/kg gain (N/kg)	184.61	205.56	184.50	207.91	186.21	

SEM = Standard Error of Mea; **NF**= Non-fermented; **F**= Fermented; **KSC=** Kapok seed cake

higher than the value of those birds fed the control (0% KSC) diet. The fermented KSC diets at 10 or 15% dietary level resulted in significantly higher feed intakes than those fed the 10 and 15% non-fermented KSC diets. The lowest feed intake was recorded by the birds fed with 15% non-fermented KSC diet. The result for feed conversion ratio showed that birds fed the 0 and 10% fermented KSC diets had the best values. Similarly, feed conversion ratio for those fed 10% fermented KSC diet was similar to those fed with the 15% fermented KSC diet. The birds fed with 15% non-fermented KSC diet had significantly ($P < 0.05$) poorest feed conversion ratio (Table 2).

Result for mortality showed that birds fed the control diet had the least mortality rate. Mortality rate for birds fed with 10% fermented KSC diet gave significantly higher mortality ($P < 0.05$) than those fed the control diet but significantly lower than those of birds fed 10% non- fermented KSC diets and those fed with 15% fermented or non-fermented KSC diets. The highest mortality was recorded for the birds fed 15% non-fermented KSC diet. Cost per kilogram analysis revealed that fermentation increased the economic value of FKSC in diet as broiler chickens fed with 15% FKSC diet showed the lowest significance ($P < 0.05$) cost per kg gain which is significantly lower than the value recorded by those fed with 0 and 10% of NFKSC diets. They had similar ($P > 0.05$) values that were significantly lower than values recorded by birds with 10% FKSC and 15% NFKSC diets which had the least significant values that were similar ($P > 0.05$). No significant negative effects on haemoglobin, total protein and packed cell volume up to 10% FKSC were observed (Table 4).

Table 3. Comparison of the pooled effect of fermentation or non-fermentation on the utilization of kapok seed cake by broiler finisher chickens (5 -8 weeks)

S. No	Parameters	KSC (%)			
		0	**NFKSC**	**FKSC**	**SEM**
1	Av. Initial Wt (g)	1010.33	1010.25	1010.43	1.365
2	Av. Final Wt (g)	2346.00^{a}	2170.33^{b}	2332.24^{a}	30.89
3	Av. Feed Intake (g/bird)	2909.67^{a}	2805^{b}	2915^{a}	96.56
4	Av. Wt. gain (g/bird)	1230.00^{a}	1055.33^{b}	1228.88^{a}	31.22
5	Feed Conversion Ratio	2.367^{a}	2.653^{c}	2.423^{b}	0.000067
6	Mortality (%)	0.00^{a}	3.51^{c}	1.33^{b}	0.000056
7	Cost/kg gain (N/kg)	167.67	177.67	167.89	

SEM = Standard Error of Mean; **NFKSC**= Non-fermented kapok seed cake; **FKSC**= fermented kapok seed cake; **KSC=** Kapok seed cake

Table 4. Haematological profile of broiler finisher chickens fed diets containing fermented or non-fermented KSC

S. No	Parameters	KSC (%)					
		0	10NF	10F	15NF	15F	SEM
1	Haemoglobin (g/dl)	10.55^{a}	9.91^{b}	10.45^{a}	8.48^{c}	10.04^{b}	0.17
2	Total Protein (g/dl)	2.68^{a}	2.61^{b}	2.66^{a}	2.45^{c}	2.60^{b}	0.02
3	PCV (%)	29.55^{a}	28.23^{c}	29.48^{a}	26.72^{d}	28.75^{b}	0.07

SEM = Standard Error of Mean; **PCV** = Packed Cell Volume; **NF**= Non-fermented; **F**= Fermented

In this feeding trial, optimum growth in terms of average weight gain and final body weight recorded for birds fed with control (0% KSC) and 10% FKSC diets were similar. This is in agreement with the reports of Pederson *et al.* (2000) and Dei *et al.* (2008), where, they observed improved growth, better digestion and nutrient utilization. Improved growth and reduced mortality also indicate vigour and healthier condition as reported by Annongu *et al*. (1996) and Olorede *et al.* (1999). Pederson *et al*. (2000) also reported better protein digestion due to fermentation while studies by Iyayi and Aderolu (2004) showed that diets containing fermented fibrous agro-industrial by-products significantly enhanced the growth and laying performance. On contrary, results obtained by Armstrong *et al*. (1974) did not show any improvement in the growth of birds fed with fermented shea nut diet, although the tannin level was reduced, they however reported that the level of the residual tannin after fermentation of the shea nut was sufficient to inhibit growth.

Higher performance recorded for the dietary treatment with fermentation and the treatment without fermentation was due to the fact that fermentation has reduced the effect of anti-nutritional factors such as tannin in the finisher phase. This observation agrees with the reports of researchers - Thanu *et al.* (1983) and Narahari and Rajini (2003). Results obtained on cost per kilogram gain revealed that fermentation improved the utilization of FKSC in diets by birds. Hence, it allowed up to 15% of replacement of GNC without affecting cost per kilogram gain, negatively. This could have been possible due to the reduction in tannin level (about 45%) which was observed after fermentation.

The pooled effect of fermentation on the performance of broiler finisher bird fed diets containing non-fermented or fermented KSC as replacement for groundnut cake showed significant differences ($P < 0.05$) on final weight, feed intake, weight gain, feed conversion ratio, mortality, cost/kg gain except for initial weight Table 3. The dietary treatment with FKSC had better performance compared to the dietary treatment with NKFSC for final weight, feed intake, weight gain, feed conversion ratio and mortality.

CONCLUSION AND RECOMMENDATION

Fermented kapok seed cake can be incorporated at 10% dietary level in broiler finisher diets without negative effect on growth performance and haematological profile of broiler chicken.

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