EFFECTS OF DIFFERENTLY PROCESSED RED KIDNEY BEAN (*P. vulgaris L.*) ON THE PERFORMANCE CHARACTERISTICS OF BROILER CHICKENS

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ABSTRACT
An experiment was conducted to evaluate the nutritive value of red kidney bean (Phaseolus vilgaris L.) using different processing methods in broiler chicken performance. Two hundred and forty (240), seven days old Cobb 500 broiler chicks were randomly allotted to five dietary treatments replicated four times in a completely randomized design (CRD). Four differently processed red kidney bean namely; raw, salting, alum, roasting and cooking were included at 20% level. At the starter phase daily feed intake (DFI) (60.15-78.53g; P<0.001), daily weight gain (DWG) (16.75-27.2g; P<0.001) and feed conversion ratio (FCR) (2.78-3.7; P<0.001) were affected by the treatments. The finisher as well as overall phases indicated that DWG (29.33-54.1g; 23.08-40.68g; P<0.001) and FCR (2.90-5.13; 2.93-4.3; P<0.001) were significant. It was concluded that cooking was more effective in reducing anti nutritional factors in red kidney bean.
Keywords: Effects, Processed, Kidney bean, performance, Characteristics, Broiler.

INTRODUCTION
One of the major problems of poultry production in Nigeria is the high cost of feeds. Red kidney bean contains high amounts of protein and energy. Its amino acid content is similar to that of soya bean except for a lower level of methionine. However, the inclusion of red kidney bean at higher amount in the diets of animal has been reported to have detrimental effects on the performance of chickens (Jaffe, 1980; Liener, 1989) and rats (Apata and Ologhobo, 1997). This was attributed to the presence in the seeds of various biologically active compounds usually referred to as anti-nutritional factors / toxic substances.

The broad objective of this study is to evaluate the nutritive value of red kidney bean as a plant protein source in broiler diet. The specific objective is to examine the effect of differently processed red kidney bean meal on the performance of broiler chicken

MATERIALS AND METHODS
The feeding trial was conducted at the Poultry Farm of the College of Education Gindiri, Plateau State, Nigeria. This study examined the response of broiler bird's fed five (5) differently processed red kidney bean seeds viz:

(a) Raw red kidney bean (control)
(b) Salt (NaCl) treated red kidney bean
(c) Alum (AlSO4.24H2O) treated red kidney bean (d) Roasted red kidney bean (e) Cooked red kidney bean

Treatments a - e above were coded as diets 1, 2, 3, 4 and 5 respectively had the treated kidney bean included at 20% level in both the starter and finisher diets. Five (5) iso-nitrogenous and iso-caloric diets were produced for the two phases. Two hundred and forty (240) Cobb 500 one week old chicks were weighed and randomly selected and allotted to each of the five (5) dietary treatments which were replicated four (4) times. Each replicate had twelve (12) chicks in a completely randomized design (CRD). Feed and water were provided *ad libitum* while all other routine management practices were carried out to reduce disease incidence on the farm.

RESULTS AND DISCUSSION
Results show that at the starter phase daily feed intake (DFI) (60.15-78.53g; P<0.001), daily weight gain (DWG) (16.75-27.2g; P<0.001) and feed conversion ratio (FCR) (2.78-3.7; P<0.001) were significant. The finisher as well as overall phases indicated that DWG (29.33-54.1g; 23.08-40.68g; P<0.001) and FCR (2.90-5.13; 2.93-4.3; P<0.001) were affected. Birds fed cooked red kidney bean based diet had significantly higher daily weight gain than birds fed on raw, salt and alum treated red kidney based diets. This

observation agreed with an earlier report by Ofongo and Ologhobo (2007) that anti-nutritional factors could be inactivated by heat treatment. Similarly Price *et al.* (1979) reported that humid or moist heat treated, dry heat treatment and soaking in water were also effective ways of eliminating anti nutritional factors in feeds. This could be the reason that birds fed roasted and cooked red kidney bean were better in daily weight gain than birds fed on raw red kidney bean based diet. The lower performance of the birds fed raw kidney bean based diets could be due to anti-nutritional factors in raw red kidney bean which is known to have adverse effect on the health and growth of the animals (Jansman, 1993). Similar results were obtained in the daily weight gain at the starter phase, finisher phase and the overall phases with birds fed on roasted and cooked red kidney bean exhibiting significantly higher daily weight gain values.

There was significant difference ($P<0.05$) in daily feed intake among treatment diets during the starter and overall phases. The result showed that moist treated red kidney bean had better feed consumption by the birds thus cooking tends to increase palatability and protein intake as reported by Wu et al. (1996). In this study cooking reduced tannin content by 35%. The presence of tannins in diets results in reduced weight gain and poor feed efficiency (Ahmed, 1991). The better feed intake in birds fed heat treated red kidney bean agreed with an earlier report which indicated that cooking is more effective in removing trypsin inhibitor and hemaglutinin than decortications after soaking Emiola *et al.* (2004).

The feed conversion ratio is the feed consumed per unit weight gain and therefore measures how efficient the birds convert feed consumed into meat. Feed conversion ratio showed significant difference ($P<0.05$) in birds fed heat treated red kidney bean based diets as compared to those on raw and alkaline soaked red kidney bean based diets. FCR recorded in this study did not agree with FCR value of 2.50 reported by Olomu (1995) but is higher than FCR of 1.89-2.04 reported by Pour-Rezza and Edriss (1997) when some plant protein sources were used for broiler chicken diet. Since FCR is the measure of the efficiency of the bird to convert feed consumed into meat the lower the value the better the FCR. Thus heat treated red kidney beans were better utilized.

CONCLUSION

Based on this study, it was therefore concluded that salt and alum treatments are not effective methods in reducing anti-nutritional factors in red kidney bean compared to moist and dry heat treatments.

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Table 1: Ingredients composition (%) of broiler starter mash containing differently processed red kidney bean (1-4weeks)

	Red kidney bean processing methods				
Ingredients	RKB	STKB	ATRB	RTKB	COKB
Maize	39.00	39.00	39.00	39.00	39.00
Full fat soya bean	21.00	21.00	21.00	21.00	21.00
Red kidney bean	20.00	20.00	20.00	20.00	20.00
Wheat offal	10.00	10.00	10.00	10.00	10.00
Fish meal	6.00	6.00	6.00	6.00	6.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Limestone	1.00	1.00	1.00	1.00	1.00
+Vit. Min. Premix	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Lysine	0.20	0.20	0.20	0.20	0.20
Methionine	0.30	0.30	0.30	0.30	0.30
Total	**100**	**100**	**100**	**100**	**100**
Calculated Analysis					
Crude protein (%)	23	23	23	23	23
Ether extract (%)	6.6	6.6	6.6	6.6	6.6
Calcium (%)	1.4	1.4	1.4	1.4	1.4
Phosphorus (%)	0.9	0.9	0.9	0.9	0.9
Crude fibre (%)	4.0	4.0	4.0	4.0	4.0
Lysine (%)	1.1	1.1	1.1	1.1	1.1
Methionine(%)	0.6	0.6	0.6	0.6	0.6
ME(kcal/kg)	2962	2962	2962	2962	2962

+. Bio-mix broiler starter premix supplied per kg diet, Vit A 10,000, 000iu; Vit $D_3$2, 000,000iu;Vit E23,000mg;Vit$K_3$2,000mg;Vit$B_1$1,800mg;Vit$B_2$5,500mg;Niacin27,500mg;Pantothenicacid7,500 mg; Vit B_6 3,000mg; Vit B_{12} 15mg; Folic acid 750mg; Copper 3,000mg; Iodine1,000mg; Iron 20,000mg; Manganese 40,000mg; Selenium 200mg; Zinc 30,000mg; antioxidant1250mg.

KEY

RKB = Raw kidney bean
STKB = Salt treated kidney bean
ATKB = Alum treated kidney bean
RTKB = Roasted kidney bean
COKB = Cooked kidney bean
ME = Metabolizable energy

Table 2: Ingredients composition (%) of broiler finisher diets containing differently processed red kidney bean (5-8 weeks)

Ingredients	Red kidney bean processing methods				
	RKB	STKB	ATRB	RTKB	COKB
Maize	41.00	41.00	41.00	41.00	41.00
Full fat soya bean	16.00	16.00	16.00	16.00	16.00
Red kidney bean	20.00	20.00	20.00	20.00	20.00
Wheat offal	15.00	15.00	15.00	15.00	15.00
Fish meal	4.00	4.00	4.00	4.00	4.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Limestone	1.00	1.00	1.00	1.00	1.00
+Vit. Min. Premix	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Lysine	0.20	0.20	0.20	0.20	0.20
Methionine	0.30	0.30	0.30	0.30	0.30
Total	**100**	**100**	**100**	**100**	**100**
Calculated Analysis					
Crude protein (%)	20	20	20	20	20
Ether extract (%)	5.8	5.8	5.8	5.8	5.8
Calcium (%)	1.3	1.3	1.3	1.3	1.3
Phosphorus (%)	0.9	0.9	0.9	0.9	0.9
Crude fibre (%)	4.3	4.3	4.3	4.3	4.3
Lysine (%)	1.0	1.0	1.0	1.0	1.0
Methionine(%)	0.6	0.6	0.6	0.6	0.6
ME (kcal/kg)	3053	3053	3053	3053	3053

+ Biomix broiler finisher premix supplied the following per kg diet VitA 8,500,000 IU, Vit $D_3$1,500,000iu; Vit E 10,000mg; Vit K_3 1,500mg; Vit $B_1$1,600mg; Vit B_{12} 4,000mg; Niacin 20, 000mg; Pantothenic acid 5,000mg; Vit $B_6$1,500mg; Vit B_{12} 10mg; Folic acid 500mg; Biotin 750mg; Choline chloride 175,000mg; Cobalt 200mg; Copper 3,000mg; Iodine 1,000mg; Iron 20,000mg; Manganese 40,000mg; Selenium 200mg; Zinc 30,000mg; anti-oxidant 1250mg

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RKB = Raw kidney bean
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RTKB = Roasted kidney bean
COKB = Cooked kidney bean
ME = Metabolizable energy

Table 3: Performance of broiler chickens fed diets containing differently processed red kidney bean based diets

	Diets					
Parameters	1 RKB	2 STKB	3 ATKB	4 RTKB	5 COKB	SEM
Initial weight (g)	90.44	90.34	90.91	90.25	94.32	2.37^{NS}
Body weight at week 4 (g)	469.00^{b}	609.00^{a}	561.40^{b}	677.50^{a}	761.60^{a}	26.60***
Final weight gain (g)	1203.70^{c}	1708.70^{c}	1800.00^{bc}	2302.50^{ab}	2785.50^{a}	107.98***
Starter phase (1-4 weeks)						
Daily feed intake (g)	61.20^{b}	60.15^{b}	60.75^{b}	75.33^{a}	78.53^{a}	1.58***
Daily weight gain (g)	16.75^{b}	21.75^{ab}	20.05^{b}	24.20^{a}	27.20^{a}	0.95***
Feed conversion ratio	3.70^{a}	2.78^{b}	3.05^{b}	3.10^{ab}	2.88^{b}	0.13***
Mortality (number)	1	1	1	1	-	
Finishing phase (5-8 weeks)						
Daily feed intake (g)	141.18	144.12	141.75	149.52	156.63	4.78^{NS}
Daily weight gain (g)	29.33^{b}	29.18^{b}	29.08^{b}	48.13^{a}	54.10^{a}	2.34***
Feed conversion ratio	4.85^{a}	5.13^{a}	4.93^{a}	2.95^{b}	2.90^{b}	0.34***
Mortality (number)	1	1	1	1	-	
Overall phase (1-8 weeks)						
Daily feed intake (g)	101.20^{b}	102.22^{b}	101.28^{b}	112.45^{b}	117.62^{a}	2.62**
Daily weight gain (g)	23.08^{b}	25.50^{b}	24.58^{b}	36.20^{a}	40.68^{a}	1.26***
Feed conversion ratio	4.30^{a}	3.95^{b}	4.03^{ab}	3.15^{bc}	2.93^{c}	0.17***
Mortality (number)	2	2	2	2	-	

Means in the same raw with different superscript differ significantly (*P<0.05; **P<0.01; ***P<0.001)
SEM = Standard error of the mean

KEY

Diet 1 – Raw red kidney bean Diet 2 – Salt treated red kidney bean Diet 3 – Alum treated red kidney bean
Diet 4 – Roasted red kidney bean Diet 5 – Cooked red kidney bean