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Peformance of Broiler Chickens Fed Differntly Processed Red Kidney Beans Seed Meal (*Phaseoulus Vulgaris*) as Poultry Feed Resource

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ABSTRACT: *An 8 weeks feeding trial was conducted to evaluate the nutritive contribution of red kidney bean (phaseoulus vulgaris) seed meal on growth performance, carcass and internal organ characteristics and economics of production of broiler chickens. Two hundred (Anak-2000) white strain day old broiler chicks were weight and assigned to five groups of forty chicks each. Each group was further divided into four groups of ten birds per replicate in completely randomized design. Five diets were formulated using differently processed Red kidney bean seed meal (Phaseoulus vulgaris) at 0% in the control (T_1) and 25% levels of inclusion for Raw (RRKBSM), Toasted (TRKBSM), boiled (BRKBSM) and Dehaulled (DRKBSM) respectively. Feed and water were given ad-libtum daily throughout the feeding trial. The growth performance showed significant (P<0.05) difference for all the parameters. However, there were significance (P<0.05) for live weight, dressed weight, plucked weight, breast weight, back, thigh, drumstick, shank, kidney and lungs. Similarly cost/kg feed was higher in T_4 (₦ 449.91) and lowest in T_2 (₦ 424.20). Feed cost/kg weight gain was higher in T_5 (₦ 440.93/kg) gain and lowest feed cost/kg gain was on T_4 (₦ 308.14/kg) gain. From the foregoing, it implies that RKBSM is a potential feed resource and could be included in diets of broiler chickens when differently processed up to 25% inclusion level as protein source in broiler chicken diet for growth and performance.*

KEYWORDS: performance, red kidney bean, broiler chickens, carcass characteristics, economics.

INTRODUCTION

Feed supply has remained a major constraint in livestock production due to the ever-increasing cost of conventional feed stuff occasioned by the competition between man and livestock (Amaefule *et al.*, 2004). The level of animal protein consumption in Nigeria is estimated at *8.27g per caput per day* as against *35g per caput per day* (Amaefule *et al.*, 2009). Consequently, the prices of the finished products (meat and egg) are not affordable hence the reduced protein intake. An average Nigerian does not consume enough protein of animal origin that nourishes the body for tissue development, repairs and healthy living (FAO, 1992).

Efforts have been made to use other legume seeds as sources of protein such as Pigeon pea (Amaefule and Obioha, 2001) Mucuna pruriens seeds (Emenalom and Udedibie, 1998) and Jack bean (Esonu *et al.,* 1998) in monogastric diets with encouraging results. Therefore, a possible way of increasing the supply of animal products at a cheaper price is by reducing the cost of production through the use of cheaper locally available source of protein such as kidney bean in place of the imported and costly fish meal, industrial groundnut cake and or soya bean meal. Red kidney bean is rich in dietary fibre and low in fat (Krupa, 2008) Emiola *et al.* (2007) reported that red kidney bean (*Phaseolus vulgaris*) is considered as a potential component of diets of pigs and poultry.

The kidney bean (*Phaseolus vulgaris*) also known as common bean, haricot bean, navy bean, dry bean, snap bean, French bean and pinto bean are native of Central America. They are now being grown, in several parts of the world (Olomu, 2011). The bean is an herbaceous annual plant grown worldwide for its edible fruit, either the dry seed or the unripe fruit both of which are referred to as beans. Some are harvested immature and the whole pod eaten. The use of common beans in poultry and rat diets has not been too successful because of the depressing effects on performance except when anti-nutritional factors present in the seeds are deactivated (Olomu, 2011).

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 (20%) in the diets of animal has been reported to have detrimental effects on the performance of chickens (Esonu, O. O. 2001) and rats (Apata and Ologhobo 1997). However, it has been established that heat treatment and other processing methods exert beneficial efforts on the seeds of the grain legumes by destroying the anti-nutritional factors inherent in them (Balogun *et al.,* 2001). Some of the anti-nutritional factors are however thermostable, requiring different processing methods applied individually or in combination. For instance, the effectiveness of heat treatment in detoxifying Tannin, phytate and oxalate in Kidney beans has been found to be low (Emiola *et al.,* 2007). Tannin in animal nutrition has been reported to include intestinal damage, interfere with iron absorption. They are known to generally impair conversion efficiency in poultry with subsequent reduction in weight gain (Reed, 2001). Phytic acid inhibits the action of gastro- intestinal tyrosinase, trypsin, pepsin, lipase and amylase (Liener, 1980 and Khare, 2000). Oxalates are known to precipitate calcium in the gastro-intestinal tract as insoluble oxalates. Diets containing oxalates have been shown to cause calcium deficiency in animals (Hang, *et al.,* 2010). Therefore, to inactivate these anti-nutrient substances in legume seeds, emphasis has been on different processing methods. In view of the above, Red kidney Bean seeds have been processed either by toasting (Akanji *et al*., 2003), Toasting and Boiling (Udedibe and Carnili 1997). Soaking (Akande and Fabiyi, 2010), germinating (Akande and Fabiyi, 2010), Chemical treatment Ologhobo *et al*. (1993), Supplementation with methionine (Adeyemo 2012), and supplementation with Enzyme (Abdullahi *et al*., 2023). Birds fed cooked red kidney bean based diets has significantly higher daily weight gain than birds on

raw red kidney bean. Wu *et al*. (1996) asserted that moist treated red kidney bean had better feed consumption by birds. Thus, cooking tends to increase palatability and protein intake. Results obtained from the processed methods of red kidney beans (roasting, cooking, salting, and chemical treated) improved the amino acid availability. Lysine levels in processed seeds were higher than in the raw seeds (5.00%) except for the cooked (Ghoshit, 2015). These values obtained were higher than those for groundnut cake and soya beans meal (Olomu, 1995; Serres 1999) and Balloon (1980) reported a deficiency in methionine and lysine. Damang, *et al. (*2017) reported a higher feed intake of birds fed boiled, toasted and fermented kidney bean diets were accompanied by better utilization for growth as these birds had significantly ($P<0.01$) better feed-to-gain ratio than the chicks on all other treatments. Other processing methods need to be explored in addition to heat treatment in order to reduce the anti-nutritional factors to tolerable levels in diets of broiler Chickens.
Therefore, the objective of the study was to determine the effect of differently processed red kidney bean seed meal on growth performance and utilization by broiler chickens.

MATERIALS AND METHODS

Location of Experiment

The study was carried out at the Poultry Research Farm of the Department of Animal Science and Range Management of Modibbo Adama University, Yola, Girei Local Government Area of Adamawa State, Nigeria. Farm lies between latitude 90 and 11^0 N of the equator and longitude 10 and 14^0 E of the Greenwich meridian. Adamawa shares its boundaries with Taraba state to the South and West, Gombe state to the North-West and Borno state to the North. The state has tropical climate with distinct dry and wet seasons. It has an average minimum and maximum temperature of 18^0C and 40^0C and relative humidity of 20% and 80%. Adamawa state has an international boundary with the Cameroon Republic along its eastern boarder (Adebayo, 1999).

Source of Red Kidney Bean (*Phaseolus Vulgaris)*

The red kidney bean seed was purchased from Mangu market in Mangu Local Government Area of Plateau State. The seed was subjected to the following processing methods before using it for the feeding trial.

Collection and Processing Red Kidney Bean Seeds

(i) **Sun-dried (Raw seeds)**
Raw kidney bean seed was sun dried to reduce moisture content for sufficient feed production. Seeds procured for the study were all subjected to drying before application of other processing methods. Seeds was milled at a time in a 2mm particle size hammer mill and tagged as Raw Red Kidney Bean Diet (RRKB).

(ii) **Toasting (Dry Heat Treatment)**
Raw kidney seed was placed in an open metallic frying pan and the frying pan placed firmly on a locally fabricated tripod construction to serve as oven for heat using firewood. Toasting involved sprinkling water to facilitate deeper penetration. The seeds were

stirred constantly in the frying pan to ensure uniformity, and avoid charring for 60minutes. Toasting was continued until a pleasant aroma begins to emanate. Seeds was poured on the concrete floor to cool before crushing and then used as Toasted Red Kidney Bean Seed Meal, (TRKB).

(iii)**Boiling in Alkaline Solution**

Cold clean water was brought to boiling point (100^0C) in a 200 litre capacity half cut drum; a modified method of boiling pigeon pea seeds was adopted. 100g of alkaline salt (KCO_2) potassium bicarbonate was dissolved to produce an aqueous solution. Raw red kidney bean seeds was poured into the boiling water and covered. At end of 60 minutes, the content was drained off and boiled seeds were sundried for 4 days, before milling and then used to formulate Boiled Red Kidney Bean Diet (BRKB).

(iv)**Dehaulling**

This method was carried out by use of mechanical dehaulling machine. Dehaulling machines are fabricated to meet the demand of various types of grains. Raw Red Kidney Bean Seeds was poured in a mechanical dehauller. At end of dehaulling, the resultant material was manually winnowed to remove the husk. The seeds were then be milled and used to formulate Dehaulled Red Kidney Bean Seed Diet (DRKB).

Chemical analysis

Feed and processed red kidney bean seeds samples were analysed for proximate composition according to the standard described by AOAC (2010). The metabolizable energy was estimated using the formula as expressed by Pauzenga (1985).

Table1: Proximate of Raw and Processed Red kidney Bean Seed.

Nutrients (%)		**Percentage Composition**		
	RRKB	**TRKB**	**BRKB**	**DRKB**
Dry matter (DM)	96.44	95.99	95.55	96.99
Crude protein(CP)	24.45	23.87	22.56	24.03
Crude fibre (CF)	3.68	5.23	2.78	4.78
Ether Extract(EE)	3.69	2.87	3.43	3.33
Ash Total	5.34	3.21	2.68	4.78
Nitrogen-free extract(NFE)	56.28	46.81	54.10	60.96
*ME(Kcal/kg)	3796.50	3779.40	3.755.10	3755.90

* ME(Kcal/kg) 37 x CP(%) + 81 x EE(%) +35.5 x NFE(%) (Pauzenga, 1985).
RAW – Raw Red Kidney Bean BRKB – Boiled Kidney Bean.
TRKB – Toasted Red Kidney Bean DRKB – Dehulled Red Kidney Bean

Experimental Diets

Five experimental broiler starter and finisher diets were formulated. The first diet labeled as Treatment one(T_1) was the control devoid of red kidney bean seed meal while treatments 2, 3, 4 and 5 contained raw red kidney bean (RRKB), Toasted red kidney bean (TRKB), Boiled red kidney bean (BRKB) and Dehaulled red kidney bean (DRKB) at 25% inclusion levels respectively as seen in Table 2 and 3.

Table 2: Ingredients and Percentage Composition of differently processed Red kidney Broiler Starter (1-4 weeks)

Ingredients	0% Control	25% RRKB	25% TRKB	25% BRKB	25% DRKB
			Dietary levels		
Maize	55.10	42.97	42.97	42.97	42.97
Ground nut cake	30.90	17.50	17.50	17.50	17.50
Maize bran.	3.10	3.81	3.81	3.81	3.81
Palm oil	0.10	1.35	1.35	1.35	1.35
Soya Bean meal	6.00	4.80	4.80	4.80	4.80
Red Kidney Bean	0.00	25.00	25.00	25.00	25.00
Fish meal	2.30	3.50	3.50	3.50	3.50
Bone meal	1.7	0.39	0.39	0.39	0.39
*vitamin mineral premix	0.30	0.20	0.20	0.20	0.20
salt	0.25	0.25	0.25	0.25	0.25
Lysine	0.15	0.12	0.12	0.12	0.12
Methionine	0.10	0.11	0.11	0.11	0.11
Total	**100**	**100**	**100**	**100**	**100**
Determined Analysis					
Crude protein%	22.05	22.01	22.01	22.01	22.01
ME(kcal/kg)	3007	3000	3000	3000	3000

Vitamin-mineral premix provided the following per kg: Vit A 1500 IU; Vit D_3 3000 IU; Vit E 30 IU; Vit k 2.5mg; Thamine B_1 3mg; Riboflavin B_2 6mg; Pyrodoxine B_6 4 mg; Nacine 40mg; Vit B_{12} 0.02mg; Pantothenic acid 10mg; Folic 1mg ; Biotin 0.08mg; Chloride 0.125 mg; Mn 0.0956g; Antioxidant 0.125g; Fe 0.024g; Cu 0.006g; Se 0.24; Co 0.24g

Table: 3 Ingredients and percentage composition of differently processed Red kidney bean seed meal (5-8 weeks)

Ingredients	Control 0%	RRKB 25%	TRKB 25%	BRKB 25%	DRKB 25%
			Diet Inclusion Levels		
Maize	56.10	41.96	41.96	41.96	41.96
Ground nut cake	25.00	18.88	18.88	18.88	18.88
Maize bran	6.10	4.63	4.63	4.63	4.63
Palm oil	2.80	2.80	2.80	2.80	2.80
Soya bean meal	6.00	3.46	3.46	3.46	3.46
Red kidney bean	0.00	25.00	25.00	25.00	25.00
Fish meal	1.50	1.98	1.98	1.98	1.98
Bone meal	1.70	0.61	0.61	0.61	0.61
Salt	0.30	0.21	0.21	0.21	0.21
*vit.min.premix	0.25	0.25	0.25	0.25	0.25
Lysine	0.15	0.12	0.12	0.12	0.12
Methionine	0.10	0.10	0.10	0.10	0.10
Total	**100**	**100**	**100**	**100**	**100**
Determined Analysis					
Crude protein%	19.04	19.01	19.01	19.01	19.01
ME(kcal/kg)	2923	2920	2920	2920	2920

Vitamin-mineral premix provided the following per kg: Vit A 1500 IU; Vit D_3 3000 IU; Vit E 30 IU; Vit k 2.5mg; Thamine B_1 3mg; Riboflavin B_2 6mg; Pyrodoxine B_6 4 mg; Nacine 40mg; Vit B_{12} 0.02mg; Pantothenic acid 10mg; Folic 1mg ; Biotin 0.08mg; Chloride 0.125 mg; Mn 0.0956g; Antioxidant 0.125g; Fe 0.024g; Cu 0.006g; Se 0.24; Co 0.2

Experimental Animal and Management

Two hundred (200) day old (*Anak, 2000*) white strain broiler chicks were used for the study. The birds were managed in pens on a deep litter system throughout the study. Birds were weighed and randomly allotted to five dietary treatments of 40 birds per Treatment, 8 per replicate. Each treatment was replicated 4 times in a completely randomized design (CRD). Weighed quantities of feed were supplied to each group every morning. Left-over feeds were deducted from the quantity supplied the next morning to determine the feed intake. Thereafter birds were, weighed weekly. Feed and water were supplied *ad libitum* throughout the period of the experiment for (8) weeks.

Experimental design and statistical analysis

The experimental design was completely randomized design. Data collected were subjected to one-way analysis of variance (ANOVA) as described by Steel and Torrie (1980). Mean separation were carried out as described by Duncan's multiple range test (Duncan 1955).

Carcass and internal Organs Evaluation

Eight birds from each treatment, two from each replicate were randomly selected at the end of the experiment for carcass analysis (total of 40 chickens), allowed to starve overnight to empty the crop and water offered. The following morning, selected birds were weighed to obtain the live body weight. Slaughtered birds were allowed to bleed completely, de-feathered, and eviscerated to determine the carcass weight, internal organs weight which was expressed as a percentage of the live weight.

RESULTS

Broiler starter phase (0-4 weeks)

The response of broiler starter chicks to differently processed dietary levels of kidney bean seed meal was presented in table 4. The chicks fed diets containing BRKB had significantly ($P<0.05$) highest average daily feed intake (67.23 g/bird/day) than 58.04, 53.93, 51.07 and 46.43 g for birds fed Raw, Toasted, dehaulled and Controlled diets respectively. Birds fed toasted kidney beans diets also had a significantly ($P<0.05$) Higher feed intake than those fed the control diets. Chicks fed dehaulled kidney bean diet had the least feed intake. However, there was a highly significant ($P<0.05$) difference for final weight (346.50, 442.25, 455.50, 456.60 and 678.25 g/bird). The BRKBMS (T_4) had the highest (678.25 g/bird) While DRKBSM (T_5) had the least weight. Feed conversion Ratio (FCR) did not differ significantly ($P>0.05$).

The total body weight gain of chicks fed Raw, Toasted, Boiled and Dehaulled Kidney bean was significant ($P<0.05$) among treatment groups. Boiled kidney bean had the highest body weight (639.75 g) and Dehaulled kidney bean (309.25 g) had the least.

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Table 4: Effects of differently processed RKBSM on performance of Broiler Chickens Starter Phase (1-4 weeks)

			Level of Differently Processed			
Parameter	**Control**	**RRKB(25%)**	**TRKB(25%)**	**BRKB(25%)**	**DRKB(25%)**	
	T_1	**T_2**	**T_3**	**T_4**	**T_5**	**SEM**
Initial Weight (g)	37.75	39.00	38.75	38.5	37.25	1.81^{ns}
Final Weight (g)	455.50^{b}	456.60^{b}	442.25^{b}	678.25^{a}	346.50^{b}	53.83 **
Total weight (g)	417.75^{b}	417.50^{b}	403.50^{b}	639.75^{b}	309.25^{b}	53.01 **
Total feed intake(g)	1510.00^{b}	1430.00^{b}	1625.00^{ab}	1882.50^{a}	1400.00	112.93*
Average daily feed intake(g)	53.93^{b}	51.07^{b}	58.04^{ab}	67.23^{a}	46.43^{b}	4.03*
Feed Conversion Ratio	3.63	3.4	4.0	2.9	4.5	0.30^{ns}

a, b, c, d: means within the same row having different superscript are significantly different

Broiler Finisher Phase (5-8 weeks)

The response of finisher broiler chickens to differently processed kidney beans studied was presented in table 5. Total feed intake of Chickens fed BKBSM was highest (3862.50 g) (P>0.05) and lowest (3622.50 g) for DKBSM. The Average daily feed intake was also highest on BKBSM (137.70 g/bird) as compared to TKBSM (129.73 g), RKBSM (132.10 g), and DKBSM (130.80 g) which was not significant (P>0.05). Daily weight gain was however significant (P<0.05) with 52.29 g/bird/day for birds on BKBSM. This was followed by TKBSM (44.38 g/bird/day), Compared with (42.54 and 34.68 g/bird/day) for RRKBSM and DRKBSM. This result was observed to be different for the control (47.84 g/bird/day). FCR of 2.60 was observed for birds on BRKBSM, and 2.90 for TRKBSM as against RRKBSM and DRKBSM (3.00 and 3.70) respectively.

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Table 5: Effects of differently processed RKBSM on performance of Broiler Chickens Finisher Phase (5-8 weeks)

Parameter	Control	Levels of differently processed				
		RRKB	TRKB	BRKB	DRKB	
	0%	25%	25%	25%	25%	SEM.
	T_1	T_2	T_3	T_4	T_5	
Initial Weight (g)	455.50^{b}	456.60^{b}	442.75^{b}	678.25^{a}	346.50^{b}	53.83**
Final Weight (g)	1795.00^{b}	1647.50^{b}	1655.00^{b}	2142.50^{a}	1317.50^{c}	106.59**
Total weight (g)	1339.50^{a}	1191.00^{ab}	1242.75^{ab}	1464.25^{a}	971.00^{b}	97.81*
Average daily weight gain(g)	47.84^{a}	42.54^{ab}	44.38^{ab}	52.29^{ab}	34.68^{b}	3.49*
Total feed intake(g)	3854.50	3632.50	3650.00	3862.50	3622.50	208.65^{ns}
Average daily feed intake(g)	137.70	129.73	130.40	137.90	129.40	7.45^{ns}
Feed Conversion Ratio	2.70^{b}	3.0^{ab}	2.90^{ab}	2.60^{a}	3.70^{a}	0.21*

a, b, c, d: means within the same row having different superscript are significantly different

Record on carcass yield and internal organ characteristics is presented in table: 5. The results obtained showed that there were no significant (P>0.05) difference among treatment groups for the dressing percentage with range value 65.49, 65.55, 60.88, 71.76 and 58.9 g respectively for Control (0%), RRKB, TRKB, BRKB and DRKB. While the result for the live weight, dressed weight, plucked weight, breast weight, back, thigh, drumstick, wings, shank, kidney and lungs all show significance (P<0.01) and (P<0.05) differences across treatment groups.

Table 6: Carcass yield and internal organ characteristics of broilers fed differently processed RKBSM

Parameter	Control	RRKB	Dietary Levels			
			TRKB	BRKB	DRKB	
	T_1(0%)	T_2	T_3	T_4	T_5	SEM
Live wt (g)	1695.00^{b}	1547.50^{b}	1585.00^{b}	2042.50^{a}	1217.50^{c}	106.59**
Dressed wt (g)	1107.50^{b}	1020.00^{bc}	972.50^{bc}	1467.50^{a}	735.00^{c}	111.39**
Dressing %	65.49	65.55	60.88	71.76	58.91	4.40^{ns}
Plucked wt	1620.00^{ab}	1462.50^{b}	1365.00^{b}	1820.00^{a}	751.25^{c}	95.89**
Breast wt (g)	311.50^{ab}	290.25^{ab}	299.75^{ab}	380.00^{a}	205.75^{b}	32.96**
Back (g)	148.50^{ab}	125.00^{bc}	152.25^{ab}	167.50^{a}	100.75^{c}	11.38**
Thigh (g)	211.00^{a}	161.50^{b}	155.00^{b}	207.50^{a}	124.50^{b}	14.91**
Drumstick (g)	165.00^{a}	147.75^{ab}	141.75^{ab}	179.50^{a}	111.75^{b}	13.61*
Wings (g)	134.50^{ab}	114.25^{bc}	109.50^{bc}	152.50^{a}	94.75^{c}	9.9**
Shank (g)	75.75^{a}	75.75^{a}	62.75^{ab}	74.75^{a}	52.75^{b}	4.80*
Crop (g)	9.00	8.25	10.50	10.50	13.50	2.7^{ns}
Thorax (g)	73.00	65.75	71.50	85.00	62.50	8.57^{ns}

Neck (g)	82.00	73.25	66.75	96.00	55.25	9.36^{ns}
Head (g)	52.50	46.00	36.50	51.50	36.75	5.03^{ns}
Pancreas	5.00	4.00	5.50	6.00	3.00	0.95^{ns}
Large/small intestines(cm)	135.00	112.00	128.20	119.75	90.00	12.62^{ns}
Gizzard wt(g)	2.20	2.61	2.80	1.95	2.29	0.22^{ns}
Liver (g)	2.14	2.36	2.43	2.03	2.54	0.24^{ns}
Kidney (g)	0.32^{ab}	0.84^{a}	0.55^{b}	0.39^{b}	0.82^{b}	0.11**
Spleen (g)	0.09	0.18	0.13	0.09	0.18	0.01^{ns}
Lungs (g)	0.53^{a}	0.75^{a}	0.54^{a}	0.48^{a}	0.88^{b}	0.05**
Proventriculus	0.63	0.83	0.70	0.65	0.90	0.089^{ns}
Abdominal fat	0.86	2.01	0.86	1.75	0.79	0.47^{ns}

a, b, c : means within the same row having different superscript are significantly different

Table 7: Economics of Production in Broiler Chickens Fed Differently Processed RKBSM

		Dietary Inclusion Levels				
	Control	**RRKB**	**TRKB**	**BRKB**	**DRKB**	
Parameter	T1(0%)	T2(25)	T3(25%)	T4(25%)	T5(25%)	SEM
Total feed intake (bird/kg)	3.87	3.63	3.65	3.85	3.66	0.01
Cost of feed (N/kg)	110.4	116.86	116.86	116.86	116.86	0.48
Cost of feed intake (N/kg)	427.24	424.20	426.53	449.91	427.70	1.81
Total weight gain (Kg)	1.34	1.21	1.24	1.46	0.97	0.05
Feed cost/kg weight gain	318.84	350.58	343.98	308.15	440.93	1.40

DISCUSSION

The inclusion of 25% Kidney bean seed in the diet of Chicken did affect growth in the starter phase (P<0.05) and the Finisher phase as reflected in Table 3 and 4. A reduced efficiency of feed utilization was observed which was also reflected in reduced weight gain in RRKB, TRKB and DRKB except for BRKB recorded a slightly higher gain weight. This agrees with report of (Wu *et al.*, 1996) Stating that boiling tends to increase palatability while increasing protein intake. It also supports earlier findings of (Ologhobo *et al.*, 1993) that nutritive value of legumes is enhanced by processing methods. The average daily feed intake in the starter phase was depressed in birds fed TRKB and DRKB. This supports the reports of (Udedibe and Carlini, 2000; Ologhobo *et al.*, 2003). Growth rate was depressed in birds fed (RRKB and DRKB) respectively. While there was improvement in average daily gain in birds fed BRKB. The depressed growth rate observed could be due to residual anti-nutritional factors in the meal. RRKB contains Trysin inhibitors, non-starch polysaccharides (NSP), Tannins, phytate and oxalate (Afolabi *et al.*, 1985; Udedibe and Carnili, 2000). The feed conversion ratio (FCR) was significantly improved in birds fed BRKBSM but was considerably reduced in birds fed (control), RRKBSM, TRKBSM, and DRKBSM diets. Improvement in (FCR) in BRKBSM is consistent with the findings of Ologhobo *et al.* (1993) in lima bean and Udedibe and Carnili (2000) in Jack bean. It could also be attributed to the boiling method that

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destroyed all the heat labile anti-Nutritive factors and caused reduction in others and consequently an improvement in nutritive value of the diet.

The feed intake of broiler BRKBSM diet was significantly ($P<0.05$) higher than those of other treatments. This corroborates an earlier postulation (Balogun, 2001) that heat treatment of dietary legume seed significantly improved palatability in feeds. Boiling had a more positive effect on the utilization of dietary kidney beans than Toasting by significantly improving feed intake and body weight gain. This is likely to be due to the deeper penetration of heat into the seeds by boiling water, whereas during toasting, the heat is usually more superficial. This agrees with the observation of Abeke (1997) that toasted beans may not be uniformly cooked as heat penetration into the seeds in not as effective as the case with boiling.

The lower plucked weight, dressed weight and dressing percentage for birds fed RRKBSM, TRKBSM, and DRKBSM diets resulted from their smaller live weight. Changes in the pancreatic size of birds fed RRKBSM and DRKBSM are in keeping with previous reports by Meyer *et al.* (1992) who observed pancreatic Enzyme activities in pigs fed diets containing kidney beans. These authors suggested that such effects are the consequences of poor protein digestibility and this interferes with systematic protein utilization resulting in insufficient amino acids for protein synthesis.

The economic analysis of feed cost (₦/kg) as well as feed cost/kg weight gain was reduced in T_1 (0%) diet while in T_2, T_3, T_4 and T_5 (25%) the cost increased. This result agrees with the findings of Najime (2003). However, this does not agree with the report of Ani and Okorie (2005) and Bawa (2003) who reported reduction in feed cost and total cost when unconventional legume seed meals were utilized in poultry diets. This is because these legumes are cheap and available without much competition. The cost of feed/kg recorded here is higher than values reported by Omage *et al*. (2006), and Sonaiya *et al. (*1986). The reason for the high cost may be attributed to the prevailing prices of major feedstuff such as Maize, Groundnut cake and Fish meal at time of carrying out the research.

CONCLUSION

The results can be concluded that processing methods can reduce anti nutrients such as haemaglutins, tannins, saponins, oxalates can be reduced to a reliable level. Among the processing methods, boiled red kidney bean seed meal had the best positive performance which was used as a non-conventional protein source without any effect on performance, carcass and internal organ characteristics indicating that it can compare favorably with conventional plant protein sources.

CONFLICT OF INTEREST

The authors declare no conflict of interest that may affect the outcome of the study in any way**.**

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