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Carcass Evaluation in "Broiler" Feed Diets Containing Graded Levels of Locust Beans (*Parkia biglobosa*) Seed Meal in North Western Zone of Sokoto, Nigeria

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Authors' contributions

This work is carried out in collaboration among all authors. Author AYK design the study, performed the statistical analysis. Author MMI wrote the protocol. Author ABA wrote the first draft of the manuscript and authors AAM and MSS managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

The study was carried out to evaluate the effects of feeding locust bean (*Parkia biglobosa*) seed at graded levels on the carcass characteristics of "broilers". Two hundred and forty broilers were used which were randomly allotted to four treatment groups, each replicated four times in a completely randomized design. The diets contained 0% level of LBSM which served as experimental control, while other three diets contained 5, 10, and 15% levels of LBSM. The experiment was divided into two phases (starter and finisher) each of which lasted for 28 days.

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Carcass weight and dressing percentage were not significantly influenced (P>0.05) by the experimental diet but live weight was significantly influenced (P<0.05) by LBSM. Only the back weight was significantly affected (P<0.05) by the test diet among the prime cuts. Significant difference (P<0.05) were also observed in organs weight except the abdominal fat. Analysis of variance (ANOVA) was used to determine significant difference between treatment groups in term of performance parameters. Where significant difference existed, Duncan's multiple range test was used to separate the means. Data analysis was carried out using (SPSS, 2013version 20.0). It is concluded that LBSM is safe for feeding broilers and can be included in the diet at starter and finisher phase at (5-15% - 10 and 15%) inclusion levels respectively without any deleterious effect on the growth performance.

Keywords: "Broiler"; carcass weight; diet; graded levels; locust beans seed meal (LBSM).

1. INTRODUCTION

The biggest constraint to poultry production in Nigeria is cost of feed, which accounts for about 60 to 80% of the recurrent expenditure in intensive poultry production [1]. This is because feedstuffs used in formulating and compounding diets for poultry are also in high demand for human consumption and industrial uses [2] thus, alternative feeding stuffs must be sourced. Feed ingredients that are available for human consumption like groundnut cake (GNC) and soya beans are also being competed for by the livestock sector. This situation has resulted to drastic decline in livestock production with a consequent short fall in protein intake of the people in the developing countries [3,4]. The high cost and insufficient supply of conventional plant protein ingredients (Groundnut cake and Soya beans) have necessitated the demand for alternative sources of protein for the poultry industry [3]. The search for least-cost diet is currently exploring the replacement of these expensive feed ingredients with cheaper alternatives for poultry rations. [5] suggested that alternative plant protein sources should have nutritive value comparable to or preferably cheaper than the conventional protein sources. The use of Locust beans Seed (*Parkia biglobosa)* seed meal (LBSM) is likely to reduce the cost of broiler production [6]. Earlier investigations have mentioned the food and nutritive value of *Parkia biglobosa* and other species of seeds [7,8,9]. However, *P. biglobosa* seed has been reported to contain anti-nutritional factors [10,6] such as oxalate, hydrogen cynide, tannins and phytate. Although, processing by application of heat, fermentation, cooking, sprouting and addition of enzymes has been reported to reduce or eliminate anti-nutritional factors in grain legumes [11,6]. There is a dearth of information on the replacement of soybean meal with cooked locust bean seed meal on the performance and nutrient utilization of broilers.

The key to abundant animal production is the availability of cheap and balanced feed for the animals. Feed dictates how many animals you can grow and how fast they can mature for the market [12]. There is therefore the need to intensify research into alternative feed sources that are affordable and available in order to cut down the cost of production. According to [13] Soybean has witnessed a geometric increase in price in recent times owing to its numerous potentials and high demand as feed ingredient for livestock, raw materials for industries and food for man. The seeds of locust bean are known to contain 30.36% crude protein, 5.3% ash, 20.3% ether extract and 8.82% crude fibre. The content of crude fibre and carbohydrate is fairly high for all classes of livestock [14,15]. Commercial poultry production is gradually gaining acceptance in Sokoto State. However, there are more commercial poultry farming activities in the capital city of the State than in other parts of the State. Most households and major restaurants and fast food centers within the Sokoto metropolis depend on the commercial broiler poultry farms in Sokoto metropolis for broilers poultry meat supply [16]. The populace now cherish broiler meat for daily consumption and during festivities and ceremonies unlike in the past when people considered broiler meat as being too tender and costly.

The aim of the study is to evaluate the effects of feeding locust bean (*Parkia biglobosa*) seeds at graded levels on the performance of broilers at both starter and finisher phase.

1. To determine the chemical composition of locust bean seed (*Parkia biglobosa*).
2. To determine the carcass characteristic of broiler finishers fed diets containing locust bean seed meal (LBSM).

2. MATERIALS AND METHODS

2.1 Study Area

The experiment was conducted at the poultry production and Research unit of the Department of Animal Science, Usmanu Danfodiyo University, Sokoto. Sokoto State is located between latitudes 12^0 and 13^0N and longitudes 4^0 and 6^0E in the Northern part of Nigeria at an altitude of 350m above sea level [17]. The state falls within the Sudan savannah vegetation zone with alternating wet and dry seasons. The hot dry spell extends from March to May and some time to June in the extreme northern part. A short, cool, dry period (Hammatan) occurs between late October and late February [18].

The mean annual rainfall is about 700 mm. The rainy season starts from June to early October but some time ends in September with a peak in August Potential evapotranspiration has been reported to be 162 mm. Maximum temperature of 41^OC has been reported in April and minimum of 13.2^OC in January [19].

2.2 Locust Bean Seeds Preparation and Other Feeding Stuffs

The locust bean seeds were removed from the pods and washed clean of the yellow pulp and dried as described by [20]. The seeds were boiled for eight hours in large pots on open fire to reduce or destroy the anti-nutritional factors, dried in an open air for five days before they were ground into meal and stored before the commencement of the experiment. Other ingredients for the experimental diet formulation which include maize, groundnut cake, wheat offal, bone meal and limestone were sourced from Kara market in Sokoto town while methionine, lysine and premix were sourced from established vendors within Sokoto metropolis.

2.3 Experimental Design and Diets

Four experimental diets were formulated; the first diet contained zero level of locust bean seeds meal and served as the control. The three remaining diets were formulated to contain locust bean seed meal at 5, 10 and 15% level of inclusion, respectively. The diets served as the experimental treatments that were fed to broilers during the feeding trial at starter and finisher phases, respectively. Each of the phase lasted for four weeks making a total of eight weeks. Two hundred and forty (240) day-old chicks were randomly allotted to four experimental treatment groups each replicated four times. The gross and chemical composition of the starter and finisher diets are shown in Tables 1. and 2, respectively.

2.4 Management of Experimental Birds

The day- old flock of broilers were sourced from Agric. Tech. farm (farm well) in Ibadan Oyo State and used for the experiment. Experimental birds were kept for three days after transport to take care of stress due to transportation. The birds were raised on deep litter with open sided wall and cemented floor. The house was cleaned, washed, fumigated and disinfected a week to the arrival of the chicks. Litter materials (wood shavings) were spread on the floor two days before the arrival of the chicks. Charcoal were used as a source of heat and light was connected before the arrival of the chicks. Feeding trays and small drinkers were used for the chicks during the brooding period of 0 - 4 weeks, while conical feeders and plastic container drinkers with wire guard were used during the finishing stage.

During the period anti-stress drugs such as Vitalyte were administered to the birds. After three days the birds were weighed and allotted to their treatment and replicate groups. Routine vaccination and medication were administered during the course of the trial as recommended by [1]. Feed and water was served to the chick's *ad-libitum*.

2.5 Laboratory Analysis of Locust Bean Seeds (*Parkia biglobosa*)

Proximate analysis was conducted in the Soil Science Laboratory of Usmanu Danfodiyo University Sokoto using the methods of [21] in order to determine the proximate composition of test ingredients. (Ca, Mg, P, K and Fe), Atomic Absorption Spectrometer (AAS) was used for Ca, Mg and Fe, determination, Spectrophotometer for P, and Plane Photometer was used for K determination, Samples of the experimental feed were also analyzed for proximate and mineral content.

2.6 Determination of Anti-nutritional Factors

Determination of anti- nutritional factors was conducted in the biochemistry laboratory of Usmanu Danfodiyo University Sokoto.

The Oxalate content of Parkia seeds was determined using the method described by [22],

Tannin content was determined using the standard method described by Josely [23-26] and Saponin content was determined using methods designed by Obadoni and Ochuko [27]. Determination of Oxalate.

The oxalate content of Parkia seed was determined using the method described by AOAC [22]. 2 g of the sample was weighed into a 250ml beaker; 190 ml of distilled water and 10 ml of 6 molar HCL was added to the beaker. The mixture was allowed to stand for 5 minutes while mixing it at intervals of 30 seconds. The volume was made up to 250 ml with distilled water, 50 ml was measured out and titrated using few drops of methyl red indicator while adding drop by drop concentrated ammonium until the colour became faint yellow. It was then heated on steam water bath to boil, removed and allowed to cool, before it was filtered and heated again to boil. 10ml of 5% $CaCl_2$ was added while constantly stirring, another 5 ml of $CaCl_2$ was added to give more precipitate of oxalate from the sample; it was then removed and allowed to stand overnight. The following day it was filtered and the precipitate was washed into a beaker using 1:4 H_2SO_4 and it was rinsed with 5ml of hot distilled water. The solution was heated and titrated against 0.05N KMnO4. The titre value of the blank was subtracted from that of the sample and multiplied by 50 to get the result in mg/100g of the sample.

Calculation: 1 ml of 0.05 N $KMnO_4$ = 0.0045 mg Oxalate.

3.0 x 50 = 150 mg/100 g Oxalate

2.7 Determination of Tannins

The method of estimation of tannins content was according to the standard method described by [23-26]. 5 g of sample was dissolved in 200 ml of hot distilled water. The mixture was allowed to stand for 30 minutes after which it was filtered and dried in the ovum, and the filtrate was concentrated. The dried sample was dissolved using 20 ml of distilled water, mixed properly and filtered, where a colorless solution was obtained. The solution was made up to 25 ml using distilled water in a 25ml volumetric flask.

Calculation:

Soluble tannins % = conc graph x extract volume

10 aliquote sample weight

2.8 Determination of Phytate

The method used for phytate analysis was as described by AOAC [22]. 2 g of sample was weighed into a glass stopper bottle. 50 ml of 0.5N HCl was added and shaken on an orbital shaker at 2000 rpm (revolution per minute) for about 3 hrs to ensure homogeneity and maximum extraction of phytic acid. The extract obtained was filtered using filter paper. 12 ml of the filtrate was taken and neutralized with 12 ml of 10N N3aOH. 2 ml of 20% FeCl3 solution was added to the neutralized filtrate and then placed in a boiling water bath for 15 minutes to precipitate ferric phytate. Then the solution was removed, cooled and centrifuged at 700 rpm for 7 minutes, and the supernatant discarded. The precipitate was washed with 3 ml of 0.17N HCl and transferred into a beaker. The precipitate was then heated in water bath at 80℃ for 10 minutes and 10ml of 0.5N NaOH was added to the precipitate and heated further for 15minutes to precipitate in ferric hydroxide and then it was converted to Sodium phytate. The precipitate was washed with hot water and centrifuged at 700 rpm for 7 minutes again. The supernatant was discarded and transferred into a beaker using 5 ml hot distilled water. 1 ml of concentrated H_2SO_4 and 1.2 ml of 60% per chloric acid were added to the residue (filtrate) and the mixture was digested on a hot plate to evaporate the acids. The residual per chloric acid was removed by strong heating on Bunsen burner. It was then cooled and 10-20 ml of distilled water was added and neutralized with 10N NaOH (PH 7). The volume was made up to 50 ml with distilled water and the concentration of the phytate was calculated.

Calculation: $1cm^3$ of $0.02MFeCl^3$ = 0.60mg Phytate

2.9 Determination of Saponins

Saponins was determined using the method of [28]

From the powder plant extract, five (5) gram was placed in a 250 ml flask containing 30 ml of 50% alcohol. The mixture was boiled under reflux for 30 minutes and was immediately filtered while hot through a coarse filter paper.

Two gram (2 g) of alcohol was added; the content was boiled and filtered while hot. The extract was cooled (some saponin may be seperated) and an equal volume of acetone was

added to complete the precipitation of saponins. The separated saponins were collected by decantation and dissolved in the least amount of boiling 90% alcohol and filtered while hot to remove any insoluble matter.

The filtrate was allowed to cool at room temperature thereby resulting in the precipitation of saponins. The separated saponins was collected by decantation and suspended in about 2 ml of alcohol and filtered. The filter paper was immediately transferred to a desiccator containing anhydrous calcium chloride and the saponins were left to dry. They were weighed with reference of extract used.

$$\% \, saponin = \frac{W_2 - W_1}{5_g} X \, 100$$

2.10 Determination of Cyanide

Cyanide was determined by the method reported by Railes [29]. This employs the extraction of cyanide with water and its quantitative measurement by the alkaline picrate reagent. The protocol is as follows 0.5 g of the ground sample 50 ml of distilled water was added in a corked conical flask and shaken for one hour. The mixture was then filtered using Whatman No.1 filter paper. The filtrate (1 ml) and solution of the alkaline picrate (4 ml) was added in the test tubes. The test tubes were then incubated in a water bath at 95℃ for 5 minutes. The contents in the test tubes were cooled and measured at 490 nm against a reagent blank. The amount of Cyanide was then extrapolated from the cyanide standard calibration curve. Five grams (5 g) of each sample A, B and C was added 50 ml distilled water in a conical flask and allowed to stand overnight. The 1 ml of the sample filtrate in a corked test , 4 ml of alkaline picrate was added and incubated in a water bath for 5 minutes, the absorbance of the samples was taken at 490 nm and that of blank containing 1 ml distilled water and 4 ml alkaline picrate solution before the preparation of cyanide standard curve but there was colour change in the corked test tube containing the sample which is the indication of absence of cyanide in the sample i.e. colour changed yellow to reddish brown after incubation for five minutes in water bath.

2.11 Carcass Evaluation

At the end of the experiment, three birds per replicate were weighed slaughtered, dressed and cut in to prime cuts, for carcass evaluation. Organs such as intestines, abdominal fat, liver, lungs, and gizzard were also weighed and recorded. Weight of cut parts, fat and internal organs relative to dressed weight were also determined and values were expressed as a percentage of live weight using the formula described by [30];

$$\text{Dressing } \% \quad = \frac{\text{Carcass weight}}{\text{Live weight}} \times 100$$

2.12 Data Analysis

Analysis of variance (ANOVA) was used to determine the significant difference between treatment groups in terms of performance parameters and certain evaluation of the experimental birds .Where significant differences existed, Duncan's multiple range tests [31] was applied to separate the means. Data analysis was carried out using the computer software of the statistical package for the social sciences (SPSS) version 20.0 [32].

3. RESULTS AND DISCUSSION

3.1 Proximate and Phytochemical Analyses

The result of the Laboratory analysis obtained in this study showed that *Parkia biglobosa* seed has a high Crude protein (CP) content of 29.90 %, compared to the values available in Literature. This high CP content of *Parkia seed* is not comparable with 33.50 % reported by Kehinde et al. [33], 34.3 % reported by [34] and 30. 00 % reported by Fetuga et al. [35,36,37,38,39]. The Crude Fibre content of *P. biglobosa* seed was 1.0, which is not comparable with 2.00 reported by Eka [37], 4.66 reported by [33]. The fat content of the *P. biglobosa* seed was 17.00, which is lower than 49.20 reported by [33] but higher than 4.0 reported by Odunfa [38,35]. The carbohydrate content of the *P. biglobosa* seed was 47.07, which is lower than 49.00 reported by Oke and Umoh [39]. The Ash content was found to be 5.0, which is higher than 4.81 reported by [33] and also 2.0 reported [39]. The variations may be attributed to the nature of the soil nutrient content of the area, moisture content of the LBSM, Preservation, preparation and seed treatment of the LBSM prior to the analysis.

3.2 Anti-nutritional Factors

The anti-nutritional factors of *P. biglobosa* seed obtained from the Laboratory analysis revealed that Oxalate had 0.0045 mg/100 g, phytate had

4.90 mg/100 g, tannin had 0.39 mg/100 g, Saponin had 1.14 mg/100 g and Cynanide had 0.010 mg/100 g phytochemical values. All the values obtained from this study did not agree with the values reported by Kehinde et al. [33], who reported 0.47 Oxalate, 1.30 Phytate, 0.51 tannin, 0.92 Saponin and 0.00 Cyanide content. The differences may be due to the different geographical locations and the soil on which they were cultivated or as a result of method of processing as well as difference in cultivar.
Results of carcass evaluation of broilers fed experimental diet containing graded levels of LBSM at Finisher phases is shown in Table 4.

After weighing the birds prior to carcass analysis they varied in live weight with bird selected from the group that consumed 10% LBSM being heavier (1925.00 g/b) while those fed the control diet weighed 1525.00 g/b. Similarly the carcass weight after plucking the feathers ranged from 1412.50 to1837.50 g/b with those fed 10% LBSM recording the heaviest weight. Dressing percentage stood at 81.93 and 80.08% for broilers fed the control diet and 5% LBSM while those fed 10 and 15% LBSM had 76.53 and 77.63% as dressing percentage. The only parameter or prime cut that showed significant difference was the back weight. Birds fed 5, 10, and 15% LBSM had back weights of 275.25, 293.00 and 276.00 g which were statistically similar (P>0.05). Only the back weight of birds fed the control diet was significantly lower (229.75g) (P<0.05) compared to back weight of the birds in the other dietary treatment groups.

Other parameters did not show any significant difference (P>0.05) when their means were statistically compared. Head and shank weight ranged from 120 g to 142.25 g, while weight of wings ranged from 141 g for birds fed the control diet to 153.25 g for those fed 5% LBSM. But weight of neck ranged from 79.75g for birds fed 10% LBSM to 84.25 g for those on the control diet. Breast weights were 257.25, 350.25, 325.50 and 312.25 g for broilers on the control, 5%, 10% and 15% LBSM diets. Thigh and drumstick weights for broilers in the control dietary group were 195.25 and 158.50 g, respectively while birds on 5, 10, and 15% LBSM diets had 215 and 188.75, 202.5 and 185.75 and 196.25 and 170.70 g, respectively. All other parameters weighed were not significantly different among the treatments except in the case of back weight to be significantly influenced by the dietary treatment (P<0.05).

3.3 Weights of Internal Organs of Broilers Fed Graded Levels of LBSM in their Diet

The weight of internal organs of broiler chickens fed diets containing graded levels of LBSM is shown in Table 5.

Although, it appears as if the inclusions of LBSM at 10% and 15% influence gizzard weight (52.50 g) which were similar (P>0.05), they did not also vary from the gizzard weight of the birds fed the Control Diet (49.20 g). However, birds fed 5% LBSM had the lowest gizzard weight 41.75 g (P<0.05). Similar trend was observed for weight of heart, broilers fed diet containing 10% and 15% LBSM (8.75 and 8.50 g) and those fed the Control Diet (7.00 g) were statistically similar (P>0.05) but significantly lower (P<0.05) than the value obtained from broiler fed 5% LBSM (12.00). However, weight of liver was heavier for broilers fed 5% and 10% LBSM (42.50 and 41.75) (P<0.05) compared to those fed 15% LBSM and the Control Diet (32.0 g and 32.0 g) (P>0.05). the weight of intestine follows similar pattern as that of weight of liver, broilers fed 5% and 10% LBSM had the higher weight of intestine (239.25 g and 246.50 g) which were similar but significantly different (P<0.05) from the weight of intestine of broilers fed the Control Diet (219.25 g) and 15% LBSM (205.5 g) which were also statistically similar (P>0.05).

Carcass Characteristics: The Live Weight was significantly influenced (P<0.05) by the experimental diet. The results were statistically similar for the diets contained 10%, 5% and 15 % LBSM level of inclusion. But lowest value was recorded for birds fed the control diet. The result agreed with [40] who reported significant difference among treatments with broilers chickens which were fed with cooked African Locust Bean seed meal diets at different inclusion levels. The work is in line with the report of [41,42], who reported that processing improved the utilization of protein and energy contained in legumes and thus leads to a better performance and increased feed efficiency. It has been shown that as the protein level increased the feed consumption also increases; and thus leads to better muscle deposition leaner carcass [43]. There were no significant differences (P>0.05) in the carcass weight and dressing percentage. These findings were in agreement with [44] who related that cooking timing had no significant effect on the dressing percentage. But the results disagreed with [40,41,42], who

reported that processing, improved the utilization of proteins and energy contained in legume there by making the nutrients available for utilization by the birds. From the results of prime cuts with the exception of back muscle all parameter showed no significant difference. The back muscles had significantly ($p<0.05$) higher weight for the birds fed 5%, 10% and 15% LBSM level of inclusions when compared to control diet. These findings were not in agreement with [40] who reported non-significant difference on back weight.

Weight of Organs**:** The results of gizzard weight showed significant differences ($P<0.05$), higher weight for Birds fed control diet, 10% and 15% dietary treatment level of LBSM compared with the birds fed 5% LBSM level of inclusion. The results obtained in this study is in line with the findings of [40] who found significant difference in gizzard weight for birds fed cooked African Locust bean seed meal. Similar trend was observed for the weight of heart, which had significantly ($P<0.05$) higher weight for birds fed control diet, 10% and 15% dietary treatment level of LBSM compared with the birds fed 5% LBSM level of inclusion. This results contrasts with that of [40] who observed no significant difference ($P>0.05$) in the heart weight of birds fed cooked African locust bean seed meal.

Table 1. Gross composition of experimental diets fed to the broiler starter (0-4weeks)

		Experimental	Diets	
Ingredients	**Diet I (0%)**	**Diet II (5%)**	**Diet III (10%)**	**Diet IV (15%)**
Maize	52.40	48.00	46.00	40.80
Soya BM	23.00	20.00	15.90	14.90
LBSM	0.00	5.00	10.00	15.00
GNC	16.70	16.70	15.30	15.70
W/offal	7.40	8.90	10.00	10.00
Bone meal	1.00	1.00	0.60	2.00
Vitamin premix*	0.25	0.25	0.25	0.25
Salt	0.30	0.30	0.30	0.30
Methionine	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Fish meal	0.00	0.00	1.10	0.50
TOTAL	100.00	100.00	100.00	100.00
Calculated Chemical Composition				
Metabolizable Energy (Kcal/kg)	**3000**	**3000**	**3041**	**3033**
Crude protein (%)	23.00	23.10	23.00	23.40
Lysine (%)	1.30	1.20	1.10	1.10
Methionine (%)	0.60	0.50	0.50	0.50
Calcium (%)	0.40	0.40	0.20	0.60
Available P (%)	0.40	0.40	0.30	0.40
Ether Extract (%)	4.20	3.90	3.70	3.40
Crude fiber (%)	4.00	3.90	3.60	3.40
Feed cost ₦ / Kg	139	134	132	130

**Vitamin/mineral premix contained; Vitamin A, 1000 I.U Vitamin D1, 3000 I.U., Vitamin E8.0 I.U., Vitamin K, 2.0mg; Vitamin B1, 2.0mg; Vitamin B6, 1.2mng; Vitamin B12, 0.2mg; Pantothenic acid, 7.0mg; Mg , 1000mg; Cu, 8.0mg and Se, 0.1mg per of diet*

Table 2. Gross Composition of Experimental Diets Fed to the Broiler Finisher (5-8 weeks)

		Experimental	Diets	
Ingredients	Diet I (0%)	Diet II (5%)	Diet III (10%)	Diet IV (15%)
Maize	50.00	50.00	45.80	45.00
Soya bean meal	19.00	16.05	14.00	10.00
LBSM	0.00	5.00	10.00	15.00
GNC	11.73	11.05	15.00	10.00
W/offal	13.50	13.75	15.00	14.95
Bone meal	1.50	1.20	2.50	2.50
Vitamin premix*	0.25	0.25	0.25	0.25
Salt	0.30	0.30	0.30	0.30
Methionine	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
G/oil	2.97	1.85	1.65	1.50
TOTAL	100.00	100.00	100.00	100.00

Table 3. Calculated chemical composition

Metabolizable Energy (Kcal/kg)	3000	3015	3022	3030
Crude protein (%)	20.00	20.00	20.00	19.98
Lysine (%)	1.16	1.29	1.45	1.57
Methionine (%)	0.54	0.60	0.67	0.74
Calcium (%)	0.49	0.40	0.75	0.94
Available P (%)	0.42	0.51	0.82	0.94
Ether Extract (%)	3.80	3.90	3.90	4.00
Crude fiber (%)	3.97	3.81	3.70	3.50
Cost of feed/gain₦/kg	289	284	282	280

**Vitamin/mineral premix contained; Vitamin A, 1000 I.U Vitamin D1, 3000 I.U., Vitamin E8.0 I.U., Vitamin K, 2.0mg; Vitamin B1, 2.0mg; Vitamin B6, 1.2mng; Vitamin B12, 0.2mg; Pantothenic acid, 7.0mg; Mg , 1000mg; Cu, 8.0mg and Se, 0.1mg per diet*

Table 4. Carcass Characteristics (evaluation) of Broiler Chicken Fed Diet Containing Graded Levels of LBSM

Parameter	Diet 1	Diet 2	Diet 3	Diet 4	SEM
	Control	5%LBSM	10%LBSM	15%LBSM	
Live weight (g/b)	1525.00^{b}	1772.00^{a}	1925.00^{a}	17725.00^{a}	47.43
Dressed weight (g/b)	1412.50	1662.50	1837.50	1687.50	44.37
De feathered (Dressing %)	92.62	93.82	95.45	95.20	1.12
Head & Shank Weight (g)	120.00	142.25	139.00	120.00	5.01
Neck Weight (g)	84.25	81.50	79.75	81.00	2.44
Wing Weight (g)	141.00	153.25	140.00	145.75	4.31
Brest Weight (g)	27.25	350.25	325.50	312.25	16.61
Thigh Weight (g)	195.25	215.00	202.50	196.25	5.16
Drumstick Weight (g)	158.50	188.75	185.75	170.70	6.57
Back Weight (g)	229.75^{b}	278.25^{ab}	293.00^{a}	276.00^{ab}	10.45

Means along the same row with different superscripts are significantly different (P<0.05)

Table 5. Weight of Internal Organs Obtained from Broiler Chickens Fed Graded Levels of LBSM

Parameters (g)	Diet 1	Diet 2	Diet 3	Diet 4	SEM
	Control	5%LBSM	10%LBSM	15%LBSM	
Gizzard Weight (g)	49.25^{a}	41.75^{b}	52.50^{a}	52.50^{a}	1.72
Heart Weight (g)	7.00^{b}	12.00^{a}	8.75^{b}	8.50^{b}	0.77
Liver Weight (g)	32.00^{b}	42.50^{a}	41.75^{a}	32.00^{b}	2.25
Intestine Weight (g)	219.25^{b}	239.25^{a}	246.50^{a}	205.50^{b}	8.64
Abdominal fat weight (g)	8.25	9.75	11.25	9.25	3.08

Means along the row with different superscript are significantly different (P>0.05)

However, The results of liver and intestinal weight showed significant differences (P<0.05) with higher weight for the birds fed control diet and 15% LBSM level of inclusion This results concur with those of [40], who reported that liver and intestine were significantly affected by cooked African locust bean seed meal. The author also reported that there was no significant difference in the weight of abdominal fat of birds fed cooked African locust bean seed meal which was in line with the observation made in this present study.

4. CONCLUSION

At the end of the experiment, it was concluded that *P. biglobosa* seed meal (LBSM) can be included in the diet of broilers at starter and finisher phases from 5% – 15 %, level of inclusion, without any deleterious effect on the carcass characteristics of the broiler chickens. From this study, it is recommended that *P. biglobosa* seed meal containing 10 and 15% level of inclusion would be used for better performance and economic benefit with better feed conversion ratio. However, at the finisher phase it could be recommended that, diets containing 5 and 10% LBSM level of inclusion would be used for better performance, carcass characteristics and economic benefit with better feed conversion ratio. Further research can be conducted using layers and other monogastric animals.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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