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Carcass and Meat Assessment of Broiler Chickens Fed Raw Benne Seeds (*Sesamum indicum*) Basal Diets with or Without Lysine Supplementation

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Abstract

This study was carried out to assess the effect of raw benne seeds (RBS) (*Sesamum indicum)* basal diets with or without lysine supplementation on carcass and meat characteristics of broiler chickens in an 8-week feeding trial. Raw benne seeds was incorporated into the diets at 15% and 30% while lysine was incorporated at 0.25% and 0.5% thus 7 diets were formulated as: T0 = Control; (No raw benne seeds and lysine); T1 = 15% RBS + 0% lysine, T2 = 15% RBS + 0.25% lysine; T3 = 15% RBS = 0.5% lysine; T4 = 30% RBS + 0% lysine, T5 = 30% RBS + 0.25 lysine; T6 = 30% RBS + 0.5 lysine. Total of 140 unsexed broiler chicks of Marshall strain were randomly allotted into 7 dietary groups, each group replicated 4 times at 5 birds per replicate. Fasted live, dressed carcass, and primal cuts weights as well as their percentages with exception of the back at T6 all reduced significantly ($P<0.05$) in carcasses of birds fed 30% RBS than those fed 15% RBS with or without lysine supplementation up to 0.5%. There was significant ($p<0.05$) increase in cooking loss, thermal shortening and shear force values, while water holding capacity and cooking yield decreased ($p<0.05$) in meat of birds fed 30% RBS with or without lysine. Sensory characteristics were significantly ($p<0.05$) higher in meat of birds fed 15% RBS with or without lysine supplementation than birds fed 30% RBS. Overall acceptability was higher ($p<0.05$) in meat from birds fed 15% RBS with T2 having the highest ($p<0.05$) acceptability score. The best significant improvements in the carcass and meat was in birds fed 15% RBS supplemented with 0.5% lysine, while meat acceptability was higher in those fed 15% RBS with 0.25 lysine supplementation.

Keywords: *Growth, Benne seeds, Broiler chicken, Carcass and meat assessment, Lysine supplementation*.

Introduction

The most prominent grain legumes and oil seeds that have been conveniently utilized in feeding non-ruminant animals especially poultry are soybean (*Glycine max*) and groundnut (*Arachis hypogeal*) but are fast becoming scarce and expensive due to their high demand in human diet (Apata *et al*, 2001). Among the underutilized oil seeds is benne seed (*Sesamum indicum*) which was reportedly (Akanji, *et al*; 2007) contain about 40% protein when defatted which is rich in arginine, leucine and methionine but deficient in lysine, hence it cannot be fed as the major protein supplement in broiler rations. However, Manpulu and Buhr (1991) reported that for effective utilization of benne seed there must be a sufficient supplementation with lysine. In addition to lysine deficiency, there are some inherent anti-nutritional factors in raw benne seeds that bind dietary calcium due to its high phytic oxalic acids and tannin (Ologhobo, 1992; Akanji, 2007). There had been report (Akanji, *et al*, 2008) on effect of nutritional toxicology of raw benne seeds on semen quality of adult cockerels and haematology of broiler chickens, but little has been reported on the effect of lysine deficiency in raw benne seeds on carcass and meat characteristics of broiler chicken. This study was conducted therefore, to investigate the effect of feeding raw benne seeds in diets on carcass and meat attributes of broiler chickens.

Materials and Methods

Experimental Site

This study was carried out at the poultry unit of the Teaching and Research Farm, College of Agricultural Sciences, Olabisi Onabanjo University, Yewa Campus Ayetoro, Ogun State. Ayetoro falls within latitude 7^0 15'N and longitude 3^0 3' E in derived savannah zone of Ogun state with an annual rainfall of 1900mm, maximum temperature between 29 and 34^0C and relative humidity of 81% (Onakomaiya *et al*; 1992).

Experimental Birds

Total of 140 day-old broiler chicks of Marshal strain were purchased from Obasanjo Farms, Abeokuta in Ogun state. The birds were randomly allotted to 7 groups at 20 birds per group and replicated four times at 5 birds per replicate. Feed and water were supplied ad-libitum for 8 weeks while necessary medications were administered to the birds throughout the experimental period.

Experimental Diets

Seven experimented diets were formulated with raw benne seed (RBS) and other ingredients purchased from Abeokuta market and Animal care Konsult, Ogere Remo, Ogun statewere incorporated into the diets at 15, and 30% levels. Synthetic lysine was incorporated into the diets at 0, 0.25 and 0.5% levels, while Dh-methionine was supplemented in the diets at 0.3% to ensure that the amino acid was not limiting. The starter diets were formulated to contain 23% crude protein and 3200 kcal/kg metabolizable energy, while the finisher diets contained 20% protein and 3000 kcal/kg metabolizable energy. Each of the diets formulated constituted a treatment thus T0 = Control (No Benne seeds and lysine); T1 = 15% RBS =) lysine; T2 = 15% RBS + 0.25% lysine; T3 = 15% RBS + 0.5% lysine; T4 + 30% RBS + 0% lysine; T5 = 30% RBS + 0.25% lysine; T6 = 30% RBS + 0.5% lysine as shown on Table 1 and 2.

Table 1. Percentage Composition of Experimental Starter Broiler Chicken Diets

	Treatment Diets						
Ingredient	**T0**	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**
Maize	55.00	51.20	51.20	59.95	42.20	41.50	41.25
Soybean	30.00	15.00	15.00	15.00	10.00	10.00	10.00
Benne seed	-	15.00	15.00	15.00	30.00	30.00	30.00
Fishmeal	2.50	5.00	5.00	5.00	5.00	5.00	5.00
Blood meal	2.00	3.00	3.00	3.00	3.00	3.00	3.00
B.D.G	2.70	3.00	3.00	2.75	2.00	2.45	2.45
Palmoil	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Bone meal	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Oyster Shell	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Salt	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Vitamin/Premix*	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Methionine	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Lysine	-	-	0.25	0.50	-	0.25	0.50
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Determined Analysis Crude Protein	22.89	22.89	22.84	22.86	23.24	23.26	23.28
Metabolizable Energy (kcal/kg)	3068.80	3069.30	3054.60	3056.30	3029.30	3033.00	3044.80

B.D.G = Brewer's Dry Grains

* To provide the following per kg of feed = Vit A, 66000iu, vit, D_3 1000_{in}; Vit E, 3.6_{iu}; Vit K, 1.25mg; riboflavin, 2mg; pantothenic acid, 4mg; niacin 15mg, choline, 2mg Vit B_{12}, 0.06mg; folic acid, 2.67mg; Mn, 0.06mg; Zn, 0.33mg; iodine, 0.67mg; Co, 0.8mg; Cu, 6.6mg, Fe, 6.6mg.

Table 2. Percentage Composition of Experimental Finisher Broiler Chicken Diets

	Treatment Diets						
Ingredient	**T0**	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**
Maize	58.50	55.50	55.25	55.20	45.50	45.25	45.25
Soybean	30.00	15.00	15.00	15.00	10.00	10.00	10.00
Benne seed	-	15.00	15.00	15.00	30.00	30.00	30.00
Fishmeal	1.00	4.00	4.00	4.00	4.00	4.00	4.00
Blood meal	0.50	1.00	1.00	1.10	1.00	1.00	1.00
B.D.G	1.70	1.20	1.20	1.20	1.20	1.20	1.20
Palmoil	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Bone meal	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Oyster Shell	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Salt	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Vitamin/Premix*	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Methionine	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Lysine	-	-	0.25	0.25	-	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Determined Analysis Crude Protein	20.75	20.04	20.11	20.13	20.14	20.17	20.21
Metabolizable Energy (kcal/kg)	3201.30	3204.90	3200.34	3196.40	3182.61	31.85.14	3186.41

B.D.G = Brewer's Dry Grains

* To provide the following per kg of feed = Vit A, 66000iu, vit, D_3 1000_{in}; Vit E, 3.6_{iu}; Vit K, 1.25mg; riboflavin, 2mg; pantothenic acid, 4mg; niacin 15mg, choline, 2mg Vit B_{12}, 0.06mg; folic acid, 2.67mg; Mn, 0.06mg; Zn, 0.33mg; iodine, 0.67mg; Co, 0.8mg; Cu, 6.6mg, Fe, 6.6mg.

Table 3. Chemical Composition of Raw Benne Seeds

Variable	%
Dry Matter	97.36
Crude Protein	25.53
Ether Extract	51.87
Ash	5.29
Nitrogen Free Extract	10.56
Crude Fibre	4.11

Chemical Composition of Benne Seeds

Chemical analysis of raw benne seeds used in this study was carried out following the procedures of AOAC (2002) to determine the dry matter, crude protein, ether extract, ash and crude fibre, while the nitrogen free extract was calculated by difference.

Slaughtering and carcass processing

Eight birds were randomly taken at the end of feeding trial for carcass and meat analysis. The birds were fasted for 8 hours fasted weights were recorded and slaughtered by severing the jugular veins and carotid arteries at the neck region. The carcass were processed using scalding and singeing methods after which they were eviscerated, dressed carcasses weights and dressing percentages were taken. The carcasses were then cut into primal parts, their weights and percentages taken relative to carcasses weights in each treatment group.

Physical Parameter Measurements

Cooking loss and yield

Cooking was measured with an approximately 25g meat samples removed from the breast cuts broiled in an electric oven at 105°C for 20 minutes until 72^{0}C doneness was reached according to Okubanjo (1997). The meat samples were removed cooled to room temperature (27^{0}C) and reweighed. The cooking loss was obtained as:

$$\frac{\text{Initial wt. of meat} - \text{Final wt. of meat}}{\text{Initial wt. of meat}} \times 100$$

The cooking yield was calculated as the difference between 100% and the percentage cooking loss that is (100% - cooking loss %).

Thermal shortening

This was determined according to the procedures of Honikel (1998) 25g and 6cm samples from breast cuts were used. The meat samples were broiled in an electric oven to at 105°C for 20 minutes at 72^{0}C doneness and the final length of the meat samples were taken and thermal shortening was recorded as:

$$\frac{\text{Initial length of meat} - \text{Final length of meat}}{\text{Initial length of meat}} \times 100$$

Drip Loss

25g of meat samples from breast cuts were wrapped suspended in polythene bags and were hung in a refrigerator at 4^{0}C for meats exudates to drain into the bags for 48 hours. The meat samples were removed and reweighed according to Insausti *et al*, (2001) procedures thus:

$$\textbf{Drip Loss} = \frac{Wp + j\ (Wp)}{(Wp + m) - (Wp)} \times 100$$

Where: Wp = weight of empty polythene bag

Wp + j = weight of bag and drained juice

Wp + m = Weight of bag and meat sample

Water Holding Capacity (WHC): This was determined using press method following the procedures of Mallikarjunan and Mittal (1994) thus:

$$WHC = \frac{Wt_1 - Wt_2}{Wp - Dp} \times 100$$

Where: Wt_1 = Weight of meat sample before pressing

Wt_2 = Weight of meat sample after pressing

Wp = Weight of wet filter paper

Dp = Weight of dry filter paper

Shear Force: Meat samples from breast cuts approximately 25g were broiled in electric oven at 105°C for 20 minutes and were cooled to room temperature and wrapped in another polythene bags and chilled at 4°C for 24 hours. They were removed, equilibrated to room temperature and 1.25cm parallel to muscle fibre orientation were cored manually out of the meat samples with a cork borer. The meat samples cores were sheared at 3 locations using a Warner –Bratzler V-notch blade shearing instrument (Honikel, 1998; Qiaofen and Da-Wen, 2005).

Meat Sample Sensory Evaluation

A 10 member taste panel was used to evaluate cooked (broiler) meat samples from breast cuts for colour, flavour, tenderness, juiciness, texture and overall acceptability and the scores were analysed on a 9 – point hedonic scale on which I = dislike extremely and 9 = like extremely (AMSA 1995).

Experimental design and Statistical Analysis

A completely randomized block design was used in this study, while the statistical analysis of the data collected was carried out using (SAS 2002) and all significant means were separated with Duncan multiple range test of the same software.

Experimental Design and Statistical Analysis

Completely randomized design was used, while Statistical model below,

Yij = μ+Ti+eij; where

Yij = any observation for which X1 = i

μ = general location parameter

Ti = effect of having treatment level i; was employed for this study and replicated thrice.

The statistical analysis was carried out using while significant means were separated with Duncan Multiple range test of the same software (SAS 2002).

Results and Discussion

The percentage composition of the experimental starter and finisher broiler chicken diets are show in Tables 1 and 2 while the chemical composition of raw brine seeds (RBS) is presented in Table 3 respectively. Table 4 shows the results of the carcass characteristics of experimental broiler chickens. There was significant ($p<0.05$) increase in all the carcass characteristics in broiler chickens fed diets with 15% RBS with or without some inclusion and treatment diet T3 furnished highest ($p<-0.05$) characteristics followed by T2. On the other hand, diets with 30% RBS with or without lysine supplementation had looser ($p<0.05$) broiler carcass characteristics. These results could be due to the fact that RBS contained certain anti-nutritional factor which the chicken could tolerate at 15% inclusion of RBS and better still when the diet was supplemented with lysine up to 50%. However, it seemed that the broiler chicken could not metabolize the anti-nutritional factor beyond 15% RBS inclusion in the diets hence, the decrease in the carcass characteristics observed in birds fed treatment diets T4, T5 and T6 respectively. Similar results were reported by Apata *et al* (2011) who found that carcass characteristics decreased when broiler chickens were fed raw pigeon peas which could contain some identical anti-nutrient factors that could be present in RBS. Cooking loss and thermal shortening values were higher ($p<0.05$) in meat of birds fed treatment diets T4, T5 and T6 while they were lower (p<.0.05) in meat of birds fed diets T1, T2 and T3 while meat of birds fed diet T1 had the least ($p<0.05$) values and meat of those fed diet T6 showed the highest values of 23.60 ± 1.00 and 25.73 ± 1.00. But cooking yield and water holding capacity (WHC) values were higher ($p<0.05$) in meals of chicken fed diets T1, T2 and T3 and were significantly ($p<0.05$) lower in meat of the chickens fed diets T4, T5 and T6. Shear force values were lower ($p<0.05$) in meat of broiler chickens fed diets T1, T2 and T3, while they were higher ($p<0.05$) in the meat of birds fed diets T4, T5 and T6 respectively but no significant ($p>0.05$) was observed in the drip los values of the meat as shown on Table 5. The results of broiler chicken meat physical characteristics observed in this study were also observed by Apata and Oke (2012) in their work on the effect of supplementary poultry droppings meal with motioning and lysine on the performance and meat characteristics of broiler chickens. It had been reported that WHC has influence on other meat quality factors (Sharma and Sharma 2011) such that as the WHC decreased, cooking and drip losses thermal shortening as well as cooking yield decreasing, while the shear force values increased sensory characteristics results of meat from broiler chickens fed RBS with or without lysine inclusion are presented in Table 6. Colour or cooked meat increased ($p<0.05$) up to treatment T3 and started to decrease from T4 to T6 indicating that RBS could improve the colour of broiler chickens meat supplemented with or without lysine at 15% but was enhanced with lysine inclusion at 50% but broiler meat colour decreased when RBS inclusion in the diet was increased to 30%. Flavour of broiler meat was highest ($p<0.05$) in birds fed 0%. RBS increased ($p<0.05$) up to T2 and diminished towards diet T6 which had the least (p<L0.05) flavor score. Juiciness had similar score values as flavor, while texture was highest ($p<0.05$) in meat of broiler fed diet T2 followed by those fed T3 and decreased in those fed T4, T5 and T6 respectively. Meat from broiler chickens fed treatment T2 was accepted mostly ($p<0.05$) than meat samples from chickens fed other diets. The fact the RBS could contain anti-nutritive factor that might impact unsavory taste on it (Akanji and Ologhobo, 2007), this could be transferred into the meat of broiler chickens fed RBS and the meat acceptability decreased as RBS inclusion in the diets was increased from 15 to 30%. Also many of the broiler chickens meat quality factors were higher in the meat of chickens fed T2 with high WHC, texture and relatively high colour, flavour and tenderness could have contributed, immensely to high acceptability of meat from chickens fed T2. These results agreed with the findings of Igene *et al* (2002) as well as Apata and Oke (2012).

Table 4. Carcass Characteristics of Experimental Broiler Chickens

	Treatments						
Variable	**T0**	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**
Fasted Weight	1552.00±1.00^{c}	1514.33±1.00^{d}	1707.67±1.00^{b}	1753.33±1.00^{a}	1350.32±0.52^{g}	1351.47±0.64^{f}	1353.67±0.52^{e}
Dressed Carcass wt (g)	1005.33±1.00^{b}	1003.33±0.10^{c}	117.32±0.10^{g}	1252.00±1.00^{a}	807.45±1.00^{f}	854.00±1.00^{e}	875.60±1.00^{d}
Carcass Dressing (%)	64.78±0.09^{d}	66.26±0.09^{c}	67.58±0.09^{b}	71.41±0.06^{a}	59.80±1.00^{f}	63.19±0.60^{e}	64.68±0.60^{d}
Weight of Thigh (g)	76.38±1.00^{d}	78.45±1.10^{c}	80.52±1.00^{b}	82.61±1.00^{a}	70.23±1.10^{f}	72.30±1.10^{e}	76.50±1.10^{d}
Thigh (%)	7.60±0.10^{b}	7.81±0.10^{b}	6.98±0.20^{c}	6.60±0.09^{c}	8.70±0.14^{a}	8.47±0.14^{a}	8.71±0.14^{a}
Weight of Drumstick (g)	78.42±1.00^{d}	82.20±0.10^{c}	86.32±0.10^{b}	87.51±0.10^{a}	69.45±1.00^{g}	71.50±1.00^{f}	73.40±1.00^{e}
Drumstick (%)	7.81±1.00^{ab}	8.19±0.36^{a}	7.48±0.34^{b}	6.99±0.36^{c}	8.60±0.36^{a}	8.37±0.34^{a}	8.38±0.36^{a}
Weight of Back (g)	119.71±0.08^{c}	25.51±0.09^{g}	126.71±0.10^{b}	150.64±0.10^{a}	101.41±0.07^{e}	87.31±0.06^{f}	116.12±0.08^{d}
Back (%)	11.91±1.00^{ab}	12.50±0.34^{b}	10.98±1.00^{c}	12.03±1.00^{b}	12.56±0.19^{b}	12.22±0.34^{b}	13.26±0.19^{a}
Weight of Wing (g)	64.32±1.00^{d}	65.43±1.00^{c}	67.68±1.00^{b}	74.71±1.00^{a}	54.91±11.00^{f}	53.20±1.00^{g}	61.32±1.00^{e}
Wing (g)	6.40±0.09^{a}	6.52±1.00^{a}	6.86±0.91^{a}	5.96±0.69^{b}	6.80±0.53^{a}	6.23±0.69^{a}	7.00±0.53^{a}
Weight of Breast (g)	261.61±0.01^{d}	263.62±0.03^{c}	270.81±0.02^{b}	330.12±0.10^{a}	207.14±0.01^{f}	171.10±0.01^{g}	245.34±0.10^{e}
Breast (%)	26.02±1.00^{b}	26.27±1.00^{b}	23.47±0.24^{d}	26.37±1.00^{b}	25.65±0.24^{c}	20.04±0.24^{e}	28.02±1.10^{a}

Means on the same row with different superscript are statistically Significant (P<0.05)

Table 5. Physical Characteristics of Broiler Chickens Meat

	Treatments						
Variable (%)	**T0**	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**
Cooking Loss	12.58+0.52^{g}	15.64±1.00^{f}	17.15±1.00^{e}	19.09±1.00^{d}	20.53±1.00^{c}	22.30±0.52^{b}	23.60±1.00^{a}
Cooking Yield	87.42±0.05^{a}	84.36±0.02^{b}	82.85±0.02^{c}	80.91±0.02^{d}	79.47±0.10^{c}	77.70±0.01	76.40±0.05^{a}
Thermal Shortening	15.34±0.71^{a}	15.52±0.71	18.44±1.00^{e}	20.64±1.00^{d}	22.41±1.00^{c}	23.58±1.00^{b}	25.73±1.00^{a}
WHC	80.67±0.36	75.60±0.36^{d}	67.63±0.36^{a}	65.37±0.36^{b}	57.73±0.15^{d}	55.67±0.15^{a}	53.40±0.15^{c}
Drip Loss	1.55±0.16^{b}	1.62±0.21^{b}	1.65±0.21^{b}	1.67±0.21^{b}	1.70±1.00^{b}	1.75±1.00^{b}	2.77±1.00^{a}
Shear Force (kg/cm^{3})	4.15±0.14^{c}	5.21±1.00^{b}	5.25±1.00^{b}	5.32±1.00^{b}	6.33±1.00^{a}	6.41±1.00^{a}	6.52±1.00^{a}

Means on the same row with different superscripts are statistically significant (P<0.05)
WHC = Water Holding Capacity

Table 6. Sensory Characteristics of Broiler Chickens' Meat

	Treatments						
Variable	**T0**	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**
Colour	3.53 ± 0.22^{d}	4.63 ± 0.40^{c}	$5.80+0.67^{b}$	6.85 ± 1.00^{a}	$4.77+0.67^{c}$	3.60 ± 0.22^{d}	3.51 ± 0.22^{d}
Flavour	7.83 ± 1.00^{a}	6.80 ± 1.00^{b}	6.73 ± 1.00^{b}	5.60 ± 1.00^{c}	4.55 ± 0.44^{c}	4.40 ± 0.44^{d}	4.23 ± 0.44^{d}
Tenderness	6.87 ± 1.00^{a}	5.80 ± 1.00^{b}	5.60 ± 1.00^{a}	5.53 ± 1.00^{b}	4.90 ± 0.40^{c}	4.67 ± 0.11^{c}	4.30 ± 0.11^{c}
Juiciness	7.13 ± 1.00^{a}	5.83 ± 1.00^{b}	5.50 ± 1.00^{b}	5.30 ± 1.00^{b}	3.93 ± 0.08^{c}	3.85 ± 0.08^{c}	3.80 ± 0.08^{c}
Texture	5.50 ± 0.57^{c}	6.57 ± 1.00^{b}	7.87 ± 1.00^{a}	6.57 ± 1.00^{b}	5.00 ± 0.57^{c}	4.80 ± 0.29^{c}	4.73 ± 0.29^{c}
Overall Acceptability	5.70 ± 0.21^{c}	5.87 ± 0.44^{c}	7.60 ± 0.44^{a}	6.53 ± 0.44b	5.43 ± 0.07^{c}	4.27 ± 0.06	3.20 ± 0.05^{e}

Means on the same row with different superscripts are statistically significant ($P<0.05$)

Conclusion

The results from this study revealed that carcass characteristics decreased in broiler chickens fed 30% raw benne seeds than in those birds fed 15% RBS either with or without lysine supplementation in the diets. Also meat quality characters were lower in broiler chickens fed 30% RBS, with overall acceptability of meat higher in birds fed 15% RBS with diet T2 well accepted. It could be concluded that the highest improvement in the carcass and meat was in birds fed 15% RBS supplemented with 0.5% lysine while the meat from broiler chickens fed 15% RBS supplemented with 0.25% lysine was mostly preferred.

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