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Growth, carcass and sensory traits of broiler chickens fed graded levels of extruded sesame seed meal

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Target Audience: Animal Nutritionists, Poultry farmers, Meat Scientists and Researchers.

Abstract

The study was conducted to determine the effect of graded level of sesame (Sesame indicum L.) seed meal on growth, carcass and sensory traits of broiler chicken. One hundred and eighty (180) 4weeks old Abhor acre broilers were randomly allotted into respective four (4) dietary treatments [T1 - control diet with 0% inclusion level of extruded sesame seed meal (ESSM) while T2, T3 and T4 had 25%, 50% and 75% inclusion level of ESSM respectively] in a complete randomized design. Each treatment had three (3) replicates with fifteen (15) birds per replicate. At 28-day feeding trial, the birds were slaughtered for carcass analysis and sensory traits (colour, appearance, flavor, texture, taste and overall acceptability). The data on growth, carcass and sensory traits were collected and analyzed using ANOVA and means separated using the Duncan's Multiple Range Test. Result on growth traits showed no significant ($P>0.05$) difference for final weight, weight gain and feed intake between T1 and T2. The significant ($P<0.05$) highest value in weight gain (1.55kg) was observed in T2 while the significant ($p<0.05$) least value in weight gain was in T4 (1.12kg). There were no significant ($p>0.05$) differences in percentages (%) of the carcass traits measured across the treatments with reference to the drumstick, neck, back, head, heart, liver and spleen. The dressing weight % was not significantly ($p>0.05$) different between T1 (71.34%) and T2 (70.59%) but both T1 and T2 were significantly ($p<0.05$) higher than T3 (66.70%) and T4 (65.90%). The eviscerated weight percent (EW%) and breast weight percent (BW%) had similar trend with no significant ($p>0.05$) difference between T1 and T2 [EW%: T1 (94.43), T2 (93.77) and BW%: T1 (20.82), T2 (20.59)] and significantly ($p<0.05$) higher values in both T1 and T2 than T4 (EW%: 92.35 and BW%: 17.9). The thigh weight percent (TW%) had no significant ($p>0.05$) difference between T1 (12.96) and T2 (12.84) but T1 was significantly ($p<0.05$) higher than T3 (11.96) and T4 (11.63). The *broiler chicken meat was assessed for sensory traits after cooking using a 9-point hedonic scale with reference to colour, texture and overall acceptability there were no significant ($p>0.05$) preferences observed across the treatments. The taste of the meat had least preference value in T3 (5.55) which was significantly ($p<0.05$) different from T1 (6.10) and T2 (6.35) but not significantly different from T4 (5.80). Flavour of the chicken meat from the treatments was significantly ($p<0.05$) higher in preference in T1 (5.65) than in T2 (5.00), T3 (5.05) and T4 (3.85) but between T2 and T3 no significant ($p>0.05$) difference in preference was observed and both T2 and T3 had significantly ($p<0.05$) higher preference than T4. It can be concluded that extruded sesame seed meal can be better used in partial replacement for full fat soya (protein for protein) at 25% inclusion in the diet of broilers for better growth response, carcass and sensory meat quality traits of broiler chicken.*

Key words: Broilers' performance, meat quality traits and sesame seed meal.

Description of Problem

The persistent increase in the feed cost of poultry which constitutes 60-75% of the variable cost of production necessitated the need and use of alternative feed source to achieve optimum productivity at reduced cost (1). The fish meal and other conventional plant protein sources such as soybean meal, groundnut cake (GNC) are increasing in price as such, cheap and available alternative source of protein should be sourced.

Sesame (*Sesamum indicum L.*) seed which is regarded as a rich source of both macro and micro nutrient including proteins, vitamins, calcium, phosphorus and dietary lignans cannot be overlooked as an alternative source of protein in diet of broiler. Sesame plant is a xerophyte adapted to many soil types (2). According to (3), there are about 335,000 hectares of land under sesame cultivation in Nigeria with yields of between 1.5-2.0 tonnes/hectare. Sesame seed has nutrient composition similar to other oilseed proteins incuding soybean meal and other conventional legumes (4) and its potential as dietary protein source is well-recognized (5). Thus, the potential of sesame seed as a protein source in poultry diet had caught the attention of livestock researcher (6, 7, 8, 9). When analysed, it is found that the by-products obtained after extraction of oil contains comparatively high nutritive value and in future, can be consumed as a supplement for protein rich food (10). It is one of the major oil crop grown in the world (11) and it is commonly called beniseed.

However, sesame seed contains anti-nutritional factor which is known to reduce its nutritive value in poultry feed and these anti-nutritional factors include saponin, tannins, oxalate and phytates (12, 13). Thus, reduction of these anti-nutritional factors have been explored through various processing methods like soaking, dehulling and roasting (14).

Increased production of broiler meat is greatly influence by nutrition among other factors such as breed types, housing and management as well as health care. However, in a sustainable and optimum broiler meat production the objective is not just to increase growth traits (weight gain) at low cost of feeding but also to secure the sensory meat quality traits for consumers' acceptability. Thus, this study was carried out to evaluate the growth response, carcass traits and sensory quality traits of broilers fed graded level of extruded sesame seed meal.

Materials and method

Experimental site and sesame seed processing

This study was carried out at the poultry experimental unit of the Federal College of Animal Health and Production Technology, Moor Plantation, Ibadan. The sesame seed meal used in this study was obtained by subjecting cleaned sesame seed through wet extruder machine at 76.67'C for 50 minutes. It was allowed to cool and milled before incorporating into broiler finisher diets.

Experimental birds, design and diets

One hundred and eighty (180), day-old Abhor acre four weeks broilers were used for this study. The birds were fed common diets at starter phase. At four weeks, the birds were randomly allotted to four dietary treatments T1, T2, T3 and T4 containing varying inclusion levels of extruded sesame seed meal at 0%, 25%, 50% and 75% respectively as replacement for the full fat soya portion of the diet protein for protein. There were forty-five (45) birds per treatment, replicated three times with fifteen (15) birds per replicate. The gross composition of the experimental diet is as shown in Table 1.

Table 1: Gross composition of experimental diet of broilers finisher

	Treatments			
Ingredient (kg)	T1 (0%)	T2 (25%)	T3 (50%)	T4 (75%)
Maize	50.00	50.00	50.00	50.00
Wheat offal	10.00	6.88	3.76	0.64
Soyabean meal	9.30	9.30	9.30	9.30
Full fat soya	24.00	24.00	24.00	24.00
Sesame seed meal	0.00	9.12	18.24	27.37
Fish meal (72% CP)	1.50	1.50	1.50	1.50
Bone meal	3.00	3.00	3.00	3.00
Limestone	1.50	1.50	1.50	1.50
Lysine	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10
Salt	0.25	0.25	0.25	0.25
*Broiler premix	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00
Calculated Analysis				
Crude protein	20.77	20.99	20.23	20.01
Metabolizable energy (Kcal/kg)	2942.00	2907.42	2872.83	2838.25

Housing and management

The birds were supplied feed and water *ad libitum*. The initial weight of the birds were recorded and they were subsequently weighed weekly throughout the study using weighing balance. Weight gain was measured as the difference between the final weight and the initial weight. The feed intake was obtained by deducting the weight of leftover from the weight of feed offered. The ratio of feed intake to weight gain was determined as the feed conversion ratio.

Meat quality traits assessments

At the end of the experiment, two birds were randomly selected from each of the three replicates of the four dietary treatments (making a total of 24 birds) and were slaughtered for the assessment of meat quality traits, The meat quality traits of broiler chicken assessed was the sensory meat quality traits which include colour, texture, taste, flavor and juiciness. The Sensory meat quality traits of the broiler chicken meat were assessed from the cooked meat samples of the four dietary treatments by ten (10) semi-trained panelists using a 9-point hedonic scale (Appendix I) in order to find out differences in colour, taste, flavor, texture, appearance and overall acceptability.

Proximate and Statistical analysis

The test ingredients and meat sample were analysed for proximate composition using procedure described by (15) and data obtained from analyzed meat samples were subjected to analysis of variance (ANOVA) using SAS (16). Significant treatment means were separated with Duncan option of the same software.

Results

The growth traits of broiler chicken fed varying levels of sesame seed meal is as shown in Table 2. The initial weight of the birds among the treatments ranged from 0.42 to 0.43g. T2 had the highest final weight of 1.97kg which was significantly (p<0.05) different from T3 (1.67kg) and T4 (1.47kg) but was not significantly (p>0.05) different from T1 (1.90kg). The average feed intake of T1 (4.49kg) and T2 (4.29kg) were not significantly (p>0.05) different from each other but both had a significantly (p<0.05) higher feed intake than T3 (3.49) and T4 (3.70). The average weight gain in T1 (1.48kg) and T2 (1.55kg) were not significantly (p>0.05) different but both had a significantly (p<0.05) higher weight gain than T3 (1.21kg) and T4 (1.12kg).

The feed conversion ratio (FCR) among T1 (3.03), T2 (2.77) and T3 (2.80) were not significantly (p>0.05) different from one another. But T2 and T3 had a significantly (p<0.05) lower FCR than T4 (3.30).

Table 2: Growth response of broilers feed extruded sesame seed meal

Parameters	Treatments T1	T2	T3	T4	±SEM
Initial weight (kg)	0.42	0.43	0.42	0.43	0.01
Final weight (kg)	1.90^{a}	1.97^{a}	1.67^{b}	1.47^{c}	0.31
Average feed intake (kg)	4.49^{a}	4.29^{a}	3.49^{c}	3.70^{b}	0.41
Average weight gain (kg)	1.48^{a}	1.55^{a}	1.21^{b}	1.12^{b}	0.06
FCR	3.03^{ab}	2.77^{b}	2.88^{b}	3.30^{a}	0.08

$^{a, b, c}$ Means along the same row with different superscript are significantly different (p<0.05).

The carcass traits of broiler chicken fed varying levels of extruded sesame seed meal is as shown in Table 3. There were no significant (p>0.05) differences in percentages (%) of the carcass traits measured across the treatments with reference to the drumstick, neck, back, head, heart, liver and spleen. The dressing weight (%) was not significantly (p>0.05) different between T1 (71.34%) and T2 (70.59%) but both T1 and T2 were significantly (p<0.05) higher than T3 (66.70%) and T4 (65.90%). The eviscerated weight percent (EW%) and breast weight percent (BW%) had similar trend with no significant (p>0.05) difference between T1 and T2 [EW%: T1 (94.43), T2 (93.77) and BW%: T1 (20.82), T2 (20.59)] and significantly (p<0.05) higher values in both T1 and T2 than T4 (EW%: 92.35 and BW%: 17.9). The thigh weight percent (TW%) had no significant (p>0.05) difference between T1 (12.96) and T2 (12.84) but T1 was significantly (p<0.05) higher than T3 (11.96) and T4 (11.63).

Table 3: Carcass characteristics of broilers fed extruded sesame seed meal

	Treatments				
Parameters	T1	T2	T3	T4	±SEM
Live weight (g)	2018.33^{ab}	2343.62^{a}	1824.00^{b}	1609.17^{c}	0.79
Eviscerated weight (%)	94.43^{a}	93.77^{ab}	92.95^{bc}	92.35^{c}	0.26
Dressing weight (%)	71.34^{a}	70.59^{a}	66.70^{b}	65.90^{b}	0.69
Breast (%)	20.82^{a}	20.59^{a}	19.41^{ab}	17.90^{b}	0.41
Back (%)	18.19	17.32	16.81	16.98	0.39
Wing (%)	7.96^{b}	7.70^{b}	8.32^{ab}	8.86^{a}	0.14
Thigh (%)	12.96^{a}	12.84^{ab}	11.96^{b}	11.63^{b}	0.34
Drumstick (%)	10.89	10.90	10.90	10.96	0.27
Neck (%)	3.38	3.94	3.63	4.07	0.14
Head (%)	2.35^{b}	2.35^{b}	2.61^{b}	2.98^{a}	0.07
Shank (%)	3.67^{b}	3.87^{b}	4.10^{ab}	4.79^{a}	0.14
Gizzard (%)	1.52^{b}	1.54^{b}	1.60^{b}	1.96^{b}	0.06
Heart (%)	0.43	0.47	0.41	0.48	0.01
Liver (%)	2.02	1.80	1.97	2.10	0.06
Spleen (%)	0.12	0.11	0.12	0.16	0.01

^{a,b,c} Means along the same row with different superscript are significantly different (p<0.05).

The proximate composition of meat produced from broiler chicken fed extruded sesame meal at varying levels is shown in Table 4. The ash, carbohydrate and crude fibre composition in the broiler meat samples were not significantly (p<0.05) different among T1, T2, T3 and T4.

The moisture content level was the least in T4 (67.88%) which was significantly (p<0.05) lower than T1 (68.30%), T2 (68.53%) and T3 (68.36%).

The protein level was not significantly (p>0.05) different between T1 (21.93%) and T4 (22.03%) but both T1 and T4 were significantly (p<0.05) higher than T2 (21.58%) and T3 (21.23%). The least protein level was in T3 (21.23%) which was significantly (p<0.05) lower than T1 (21.93%), T2 (21.58%) and T4 (22.03%).

The ether extract level was significantly (p<0.05) different across the dietary treatments with T3 (7.93%) > T4 (7.78%) > T2 (7.50) > T1 (7.38).

Table 4: Proximate compos ition of meat produced from broiler chicken feed graded level of extruded sesame seed meal.

	Treatments				
Parameters	T1	T2	T3	T4	±SEM
Moisture content (%)	68.30^{a}	68.53^{a}	68.36^{a}	67.88^{b}	0.14
Protein (%)	21.93^{a}	21.58^{b}	21.23^{c}	22.03^{a}	0.10
Ether Extract (%)	7.38^{d}	7.50^{c}	7.93^{a}	7.78^{b}	0.06
Ash (%)	2.38^{a}	2.38	2.48	2.38	0.07
Crude fibre (%)	0.00	0.00	0.00	0.00	0.00
Carbohydrate (%)	0.00	0.00	0.00	0.00	0.00

$^{a,b,c,\ d}$ Means along the same row with different superscript are significantly different (p<0.05).

The sensory evaluation of broiler chicken fed graded level of extruded sesame seed meal is shown in Table 5,

The broiler chicken meat was assessed for sensory traits after cooking using a 9-point hedonic scale with reference to colour, texture and overall acceptability there were no significant (p>0.05) preferences observed across the treatments. The taste of the meat had least preference value in T3 (5.55) which was significantly ($p<0.05$) different from T1 (6.10) and T2 (6.35) but not significantly different from T4 (5.80). Flavour of the chicken meat from the treatments was significantly ($p<0.05$) higher in preference in T1 (5.03) than in T2 (5.00), T3 (5.05) and T4 (3.85) but between T2 and T3 no significant ($p>0.05$) difference in preference was observed and both T2 and T3 had significantly ($p<0.05$) higher preference than T4. Juiciness of the chicken meat from the treatments was significantly ($p<0.05$) higher in preference in T1 (5.65) than in T3 (4.95) but among T1, T2 (5.15) and T4 (5.30) no significant ($p>0.05$) differences in preference. T2, T3 and T4 had no significant ($p>0.05$) differences in preference observed for juiciness.

Table 5: Sensory evaluation of broiler chicken fed graded of extruded sesame seed meal.

	Treatments				
Parameters	T1	T2	T3	T4	±SEM
Colour	6.30	6.30	6.00	6.10	0.45
Taste	6.10^{ab}	6.35^{a}	5.55^{c}	5.80^{bc}	0.26
Flavour	5.65^{a}	5.00^{b}	5.05^{b}	3.85^{c}	0.27
Texture	5.55	5.65	5.70	5.80	0.37
Juiciness	5.65^{a}	5.15^{ab}	4.95^{b}	5.30^{ab}	0.32
Overall acceptability	6.25	6.20	6.30	6.25	0.26

^{a,b,c} Means along the same row with different superscript are significantly different ($p<0.05$).

Discussion

The weight gain of birds from diets T1 (0% inclusion of ESSM) and T2 (25% inclusion level of ESSM) had no significant differences between them. This had a similar trend with earlier reports by (17) and (8). Birds on T3 (50% inclusion level of ESSM) and T4 (75% inclusion level of ESSM) had lower weight gain than T1 and T2 which was due to the corresponding lowered feed intake and could be due to anti-nutritional factors in the seed (18, 13, 8).
The final weight was significantly lower in T3 (50% inclusion level of ESSM) and T4 (75% inclusion level of ESSM) than in T1 (0% inclusion of ESSM) and T2 (25% inclusion level of ESSM) which was due to corresponding significant lower feed intake in T3 and T4 compared to the T1 and T2. The same phenomena that holds true for the weight gain also applies to the final weight in which case anti-nutritional factors in the seed may have accounted for the lower feed intake, weight gain and final weight gain in T3 and T4.This trend was in line with the earlier documents (17, 8).
The feed conversion ratio (FCR) which is a measure of conversion of feed into desired output (weight gain) is an important indicator of performance in livestock. A lower FCR value indicates better utilization of feed (increase in feed efficiency) for meat production and vice versa. In this study, the least FCR was in T2 with 25% inclusion level of extruded sesame seed meal though it was not significantly different from T1 and T3 with 0% and 50% inclusion level of extruded sesame seed meal. A similar trend was reported by (8) where 25% inclusion level of extruded sesame seed meal had FCR that is low but not

significantly different from 0% and 50% inclusion level of ESSM in an experiment where broilers where fed graded ESSM based diet. The FCR in T2 with 25% inclusion level of ESSM can be given favourable consideration for optimal meat production.

The carcass traits observed in this study such as the eviscerated weight %, dressing weight %, breast %, wing %, thigh %, head %, shank % and gizzard % had significant differences across the dietary treatments but was in favour of 25% inclusion of ESSM (T2) which in all the carcass traits measured did not differ significantly from the 0% inclusion of ESSM (T1). The fact that internal organ such as the heart, liver and spleen did not show any significant difference in size, could mean that the ESSM at 0% (T1), 25% (T2), 50% (T3) and 75% (T4) inclusion levels did not contain any appreciable levels of toxin that could be detrimental to the organs. This finding harmonizes with the report made by (19). However, on the contrary gizzard as an internal organ was found to have the largest size in T4 (75% inclusion level of ESSM) which was significantly different from the other 3-dietary treatments. This was in line with the report made by (20).

The proximate composition of the meat produced from broiler chicken fed graded level of ESSM revealed that the protein level in the meat decreased from 0% inclusion level of ESSM (T1) to 50% inclusion level of ESSM (T3) but with 75% inclusion level ESSM (T4) the protein level recorded highest though it was not significantly different from the 0% inclusion level. Considering the protein as the most valuable component from nutritional and processing point of view; it may be feasible to reckon with T4. However, considering optimal production of meat which will invariable imply more quantity of meat per output at lower cost resulting in higher weight gain and final weight of the birds as well as more quantity of protein from the broiler meat; it may be better to reckon with T2 than T4.

The sensory meat quality trait which constitute first basis for consumers' perception is the colour and next to it is the texture. Both colour and texture of the meat samples from broilers fed 0%, 25%, 50% and 75% inclusion level of ESSM had no significant differences among the dietary treatments as such this suggests that the addition of ESSM does not affect the colour and texture of the broiler meat. A similar trend was reported by (9) in terms of colour of broiler fed graded levels of ESSM. The meat samples for sensory quality traits of taste, flavor and juiciness had significant differences across the treatments. However, the significant differences across the dietary treatments for taste, flavor and juiciness had no effect on the panelists' overall acceptability of the meat samples. Thus, the meat from broiler fed 0%, 25%, 50% and 75% inclusion of ESSM were similarly acceptable by the panelists with above the threshold score value of 6.

Conclusion and application

(1) Sesame seed (*Sesamum indicum*) meal can be better used in partial replacement for full fat soya (protein for protein) at 25% inclusion in the diet of broilers for better growth response and carcass traits without any adverse

effect on the sensory attributes of the broiler meat.

(2) Farmers can include extruded sesame seed meal in broiler diets to replace full fat soybean up to 25%.

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