

Growth Performance and Apparent Nutrient Digestibility of Broiler Chicken Fed Sesame (*Sesamum indicum*) Seed Meal Diets

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Abstract

*Soya bean meal which is the major plant protein source for most livestock diets is very costly because of its high demand by man. Sesame seed meal is less expensive and contains protein this is rich in methionine, cysteine and tryptophan and could be a good replacement for soya bean in broiler diets. Ninety-six day-old unsex broiler chicken (ROSS 308 strain) were used to determine the performance and nutrient digestibility of broiler birds fed sesame (*Sesamum indicum*) seed meal diets. Each treatment was assigned twenty-four (24) birds with three replicates having eight birds in each replicate. Four diets were formulated, diet one (T_1) served as the control (diet without sesame seed meal); diet two, three and four (T_2 , T_3 , T_4) contained sesame seed meal at inclusion levels of 5%, 10% and 15% respectively. Performance parameters measured were live weight, feed intake, weight gain, feed conversion ratio, and mortality. Six birds per treatment, two from each replicate, were picked on day 48 and moved to the metabolism cages for apparent nutrient digestibility study in a completely randomized design. The experiment lasted for 56 days. Data collected were subjected to analysis of variance (ANOVA) and the significant means were separated using the Duncan's Multiple Range Test. The performance showed no significant ($P > 0.05$) differences between T_1 , T_2 and T_3 in the final live weights (2791.67g, 2591.67g and 2500.00g respectively) but these were significantly ($P < 0.05$) higher than T_4 (2108.33g). This was an indication that higher levels of sesame seed meal depressed performance. The apparent nutrient digestibility showed that crude protein was not significantly different ($P > 0.05$) among the treatment groups. However, significant differences ($P < 0.05$) existed for dry matter (DM), ether extracts (EE), crude fibre (CF), crude ash (ash), nitrogen free extract (NFE) and gross energy (GE) digestibility coefficients. The apparent digestibility of broiler birds fed diets containing varying levels of sesame seed meal did not show any negative impacts on the nutrient*

utilization. The use of sesame seed meal as a potential protein source for the production of broiler chickens up to 10% dietary inclusion is therefore recommended.

Keywords: Broiler chickens, Growth performance, Sesame seed meal, Apparent nutrient digestibility

1.0 Introduction

Sesame (*Sesamum indicum*), is an important and ancient oil-yielding crop cultivated for its flavor. Sesame seed meal is the by-product of sesame oil industry with numerous desirable features; it is a significant source of protein as a functional feed ingredient or as dietary supplements (Achouri *et al* 2012). Compared to soybean meal, sesame seed meal is low in lysine, isoleucine, leucine, and valine. It is, however, a good source of the sulfur-containing amino acids, including methionine (Ukpanah *et al.*, 2022; Achouri *et al* 2012). Sesame seed commonly referred to as sesamum or benniseed, a member of the family *Pedaliaceae*, is one of the most ancient oilseed crops known to mankind. Sesame seed is grown primarily for its oil-rich seeds. The seed is rich in protein and the protein has an amino acid profile with good nutritional value (Gbadamosi *et al.*, 2017). The chemical composition of sesame shows that the seed is an important source of oil (44-50%), protein (18-25%), carbohydrate (13.50%) and ash (~5%) (Gbadamosi *et al.*, 2017). Sesame seed meal is an excellent livestock feed with a high-level protein (37.5 – 45.10%) on dry matter basis and a gross energy content of 4620 – 4970 kcal/kg (Fagbenro *et al.*, 2010; Ali *et al.*, 2019; CIRAD, 2021). It contains protein which is rich in methionine, cysteine and tryptophan. Its protein isolate can be added to poultry feeds to give a better nutritional balance; besides, sesame seed meal is more accessible and has minimal utilization.

One of the major problems of poultry producers is the high cost of feed which arises mainly from the competition between man and poultry for conventional feedstuff like maize, groundnut cake, soya bean meal (SBM), and fish meal (Akpa, *et al.*, 2010; Amaefule *et al.*, 2011; Sam, *et al.*, 2019). Soya bean meal which is the major plant protein source for most livestock diets is costly because of its high demand by man, industries and animals; besides, soybean is deficient in methionine, cysteine and tryptophan (Ogunwole *et al.*, 2014).

This study shall update the available information on the effect of inclusion of sesame seed meal in broiler production. When the dietary levels of inclusion of sesame seed meal is established for broiler chicken, it will help improve broiler diet production.

2.0 Materials and Methods

2.1 Experimental Site

The research was conducted at the Research Farm of the Department of Animal Science, Akwa Ibom State University, Nigeria. Located on latitude $5^{\circ}17^1$ and $7^{\circ}27^1$ North and longitude $7^{\circ}27^1$ E and $7^{\circ}58^1$ E of the equator; with the temperature range between 24-25°C, average annual rainfall range between 3500- 5000mm and relative humidity between 60-90% (Daniel and Nwaowo, 2018).

2.2 Experimental Birds and their Management:

Ninety-six (96) day-old birds were procured from a reputable distributor for the experiment. They were weighed and assigned to four (4) dietary treatments; each treatment had three replicates of 8 birds per replicate in a completely randomized design. The birds were raised in deep litter pens; wood shaving was used as litter material. Feed and clean water were given *ad-libitum*. The broilers were vaccinated against Newcastle disease (intraocular) on day one, *Lasota* at week four and *Gumboro* disease vaccine at the 9th and 21st days of life. Other routine management practices in terms of medications, sanitation and vaccination were strictly observed. The experiment lasted for 56 days.

2.3 Experimental Diets

Sesame seed meal was procured from a local dealer and used to formulate a single straight diet (Onunkwo and Okocha, 2018). The proximate composition of the sesame seeds (*Sesamum indicum*) meal is presented on Table 2.1 below.

Table 2.1: Proximate composition of sesame seed (*Sesamum indicum*) meal

Nutrient	Composition (%)
Dry matter	90.09 ± 0.07
Crude protein	40.99 ± 0.10
Ether extract	7.63 ± 0.00
Crude fibre	5.84 ± 0.07
Ash	11.80 ± 0.00
Nitrogen free extract	23.84 ± 0.00
Gross energy (kcal/g)	4.04 ± 0.07
± Standard error of mean	

Four experimental diets were formulated, Treatment one (T₁) represented the control; diet two, three and four (T₂, T₃, T₄) contained sesame seed meal at inclusion levels of 5%, 10% and 15% respectively, to replace soybean meal as presented in Table 2.2 below.

2.4 Data Collection

The growth performance parameters measured were, daily feed intake which was determined by subtracting the weight of feed not consumed from the weight of feed given to birds. Average feed intake/bird/day was gotten by dividing the feed consumed by the number of birds and by the number of days of the experiment. Body weight gain was calculated by subtracting the initial body weight from the final body weight. The average daily weight of the birds was calculated by dividing the body weight gain by the number of birds and by the number of days of the experiment. Feed conversion ratio was calculated by dividing the quantity of feed consumed by the weight gain.

Table 2.2 Composition of the experimental diet (kg)

Ingredients	T ₁ (0%)	T ₂ (5%)	T ₃ (10%)	T ₄ (15%)
Maize	52.00	52.00	52.00	52.00
Soybean meal	20.00	15.00	10.00	5.00
Groundnut cake	10.00	10.00	10.00	10.00
Sesame seed meal	-	5.00	10.00	15.00
Fishmeal	3.00	3.00	3.00	3.00
Wheat offal	11.20	11.20	11.20	11.20
Bone meal	3.00	3.00	3.00	3.00
Starter premix	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Lysine	0.20	0.20	0.20	0.20
Methionine	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00
<i>Calculated analysis</i>				
Crude protein (%)	22.05	21.90	21.75	21.60
Metabolizable energy (kcal/kg)	2866.88	2884.34	2901.88	2919.38
Crude fibre (%)	3.80	3.73	3.65	3.58
Calcium (%)	1.13	1.13	1.13	1.13
Phosphorous (%)	0.76	0.75	0.74	0.73

Vitamin /mineral premix – vitamin A, D3, E, K, B1, B6, B12, Nacin, pantothenic acid, folic acid, biotin, chlorine, chloride, manganese, zinc, iron, copper, iodine, selenium, cobalt and antioxidants.

2.5 Digestibility Study

Six birds per treatment and two birds per replicate were randomly selected on the 48th day (week seven) of the experiment and moved to the metabolism cages for apparently nutrient digestibility study. The birds were housed in the metabolism cages to continue with their experimental diets, the birds were housed separately in individual compartments for seven days. Three days of acclimatization were allowed before the commencement of the digestibility study during which time both feed and water were given *ad libitum*. Feed was measured and given daily to each bird. To reduce wastage, feeding was done thrice daily, by 8.00am, 1.00pm and by 6.00pm. Every morning before feeding, the feed not consumed, and the feed intake was measured and recorded. Faeces were collected, weighed and stored in the refrigerator. At the end of the trial, the faeces collected were oven dried at 60⁰C to constant weight. The dried faecal samples were ground to pass a 1mm sieve. Seven days faecal sample collection was pooled and thoroughly mixed together. A little quantity was collected from each treatment and preserved in a refrigerator from which the proximate analysis was carried out according to AOAC (2005). The apparent nutrient digestibility was calculated as shown below.

$$\text{Apparent nutrient digestibility} = \frac{\text{Nutrient in feed} - \text{Nutrient in faeces}}{\text{Nutrient in feed}} \times 100 \dots \text{Equation 2.1}$$

2.6 Data Analysis

Data collected was subjected to analysis of variance (ANOVA) according to Steel and Torie (1980). The significant means were separated using the Duncan's Multiple Range Test (DMRT).

3.0 Results and Discussion

3.1 Growth Performance

The growth performance of broiler chickens fed varying levels of sesame seed meal is presented in Table 3.1. There were no significant ($p > 0.05$) differences between T_1 , T_2 and T_3 in the final live weights/bird (2791.67, 2591.67 and 2500.00) g which were significantly ($p < 0.05$) higher than T_4 (2108.33g). The Average weight gain also followed the same trend, but no significant ($P > 0.05$) differences were recorded in feed intake, feed conversion ratio and mortality. The result is an indication that higher levels of sesame seed meal depressed performance. This result agrees with several authors (Tuned-Akintunde *et al.*, (2012); Ali *et al.*, (2019) and Owosibo *et al.*, (2017) who recorded reduction in growth at increased levels of sesame seed. The mortality recorded during this phase could be attributed to the environmental condition and not the dietary treatments. Akanji, (2015) also reported that the mortality rate of broilers fed sesame meals at different inclusion levels were not affected significantly ($P > 0.05$).

Table 3.1: Growth performance of broiler chicken fed diets containing graded levels of sesame seed meal

Parameters	T_1 (control)	T_2 (5%)	T_3 (10%)	T_4 (15%)	SEM
Initial weights/ bird(g)	129.71	129.71	129.71	129.71	00.00
Final live weights (g)	2791.67 ^a	2591.67 ^a	2500.00 ^a	2108.33 ^b	90.69
Average weight gain/bird (g)	2662.50 ^a	2462.50 ^a	2370.83 ^a	1979.16 ^b	90.69
Feed intake/bird (g)	4920.00	4693.39	4622.29	4333.15	103.35
Feed conversion ratio(FCR)	1.85	1.92	1.96	2.20	0.06
Mortality	0.00	8.33	4.17	4.17	1.78

^{a,b} means in a row with different superscripts are significantly different ($P < 0.05$); SEM= Standard error of mean.

3.2 Digestibility Trial

Table 3.2 shows the proximate composition and gross energy of the diets. Crude protein content ranged from 22.98 – 24.13%, ether extract ranged from 3.72-4.15%, crude fibre ranged from 3.55-3.63% and ash content ranged from 6.06-6.27%. The crude protein and crude fibre values fell within the requirements (22.50 – 24.00%), (3.50 – 4.20%) of broiler birds placed on straight diets (Essien *et al.*, 2024; Essien *et al.*, 2023; Udoh and Okah, 2014; Ewa, 2015; Onunkwo and Okocha, 2018; Udosen *et al.*, 2018; Ekpo, 2019). The gross energy content of the diet range from 4.13 – 4.27kcal/g provided the needed energy required for broiler production.

Table 3.2. Proximate composition and gross energy of experimental diets

Determined compositions (%)	T ₁ (0%)	T ₂ (5%)	T ₃ (10%)	T ₄ (15%)
Dry matter	89.24	89.17	89.46	89.35
Crude protein	22.98	23.22	23.73	24.13
Ether extract	3.72	3.78	4.10	4.15
Crude fibre	3.55	3.63	3.58	3.61
Ash	6.13	6.06	6.27	6.19
Nitrogen free extract	52.86	51.48	51.78	51.27
Gross energy (kcal/g)	4.13	4.14	4.28	4.27

The apparent nutrient digestibility of broiler chicken birds fed varying levels of *Sesamum indicum* seed meal are shown in Table 3.3. Apparent digestibility of crude protein was not significantly different ($P > 0.05$) among the treatment groups. This observation agrees, with the findings of Kareem *et al.* (2018). He reported that there was no significant difference ($P > 0.05$) in apparent nutrient digestibility of crude protein and crude fat in starter and finisher diets of broiler chickens fed larvae meal. However, significant differences ($P < 0.05$) existed for dry matter (DM), ether extracts (EE), crude fibre (CF), crude ash (ash), nitrogen free extract (NFE) and gross energy (GE) digestibility coefficients. Increasing the level of *Sesamum indicum* seed meal from 5% to 15% through an increase in dietary fat as a major component of *Sesamum indicum* seed meal did not impact any negative effects on the digestibility of the nutrients and may decrease endogenous losses of nutrients (Gbadamosi *et al.*, 2017). This was confirmed with the high digestibility coefficients observed in the present study for broiler birds fed different levels of *Sesamum indicum* seed meal. This could be attributed to the ability of the fatty acid component to aid digestion (Yasothai, 2014 and Gbadamosi *et al.*, 2017), hence reduction in hyperlipidemic metabolic disorder. According to Gbadamosi *et al.* (2017), unsaturated fatty acid which constituted about 80-82% fatty acid components of *Sesamum indicum* seed meal reduced the concentration of low-density lipoprotein (LDL) cholesterol in the blood. LDL cholesterol is a major risk for heart disease. The report by Ali and Muhammed (2013) that linoleic acid is the most significant poly unsaturated fatty acids in diets with the ability of preventing heart vascular disease strongly supported the results of this study.

4.0 Conclusion

The growth performance of broiler chicken birds in this experiment indicated that higher levels, up to 15% inclusion of sesame seed meal depressed performance. The apparent digestibility did not show any negative effects on the nutrient utilization. The use of sesame seed meal as a potential protein source for the production of broiler birds up to 10% dietary inclusion is therefore recommended.

Table 3.3 Apparent digestibility coefficients of broiler birds fed varying levels of *Sesamum indicum* seed meal

Determined compositions (%)	T ₁ (0%)	T ₂ (5%)	T ₃ (10%)	T ₄ (15%)	SEM
Dry matter	69.89 ^c	70.26 ^b	70.51 ^a	70.56 ^a	0.09
Crude protein	89.07	89.30	88.44	88.39	0.38
Ether extract	89.51 ^a	89.45 ^{ab}	89.65 ^a	89.24 ^b	0.09
Crude fibre	87.04 ^c	86.61 ^d	90.18 ^a	89.28 ^b	0.14
Crude ash	70.95 ^a	70.84 ^a	70.65 ^a	69.68 ^b	0.13
Nitrogen free extract	58.90 ^c	59.71 ^a	59.46 ^b	59.41 ^b	0.10
Gross energy (kcal/g)	88.47 ^c	88.60 ^b	88.85 ^a	88.82 ^a	0.02

a,b,c,d means within a row with different superscripts are significantly different (P<0.05). SEM = Standard error of mean

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