Nigerian J. Anim. Sci. 2016 (1):83 - 90

Sensory Evaluation and Tibia Bone Retention of Broiler Chicken Fed Graded Level of Toasted Sesame (*Sesamum indicum*l.) Seed Meal

***Adetola[1], O. O., Omojola[2], A.B., Ogunwole[2], O. A., Odetola[1], O. M, Okere[3], I. A. and Adetayo[1], T. O.**

[1]Federal College of Animal Health and Production Technology, Moor Plantation Ibadan, Nigeria. [2]Meat Science laboratory, Department of Animal Science, University of Ibadan, Ibadan, Nigeria. [3]Livestock Improvement Programme, Institute of Agricultural Research and Training, Obafemi Awolowo University, Moor Plantation, Ibadan, Nigeria.

*Corresponding author: omofunmi07@yahoo.com

Target Audience: Poultry farmer, Meat Scientists and Meat Product Processor

Abstract

An experiment was conducted for 56 days to assess the sensory evaluation of breast meat sample and tibia bone mineralization of broiler chicken fed graded level of toasted sesame seed meal. One hundred and eighty arbor acre chicks were divided into five dietary treatments. Each treatment was replicated thrice with twelve birds per replicate. The toasted sesame seed was included in broiler ration at a graded levels of 0(T_1), 25 (T_2), 50 (T_3), 75 (T_4) and 100% (T_5) respectively. Data were collected on sensory evaluation and tibia bone retention of broiler chicken fed graded level of toasted sesame seed meal. Sensory score for breast muscles revealed that significant difference (P<0.05) were observed in aroma colour Flavour tenderness and overall acceptability except juiciness. Meat of birds from T_1(0%SSM) and T_2(25%SSM) had the highest score for colour (7.11 and 7.11) and overall acceptability (6.34 and 6.22) while the least score (5.84 and 5.17) was obtained from birds on T_5 (100%SSM) respectively. While the evaluation of thigh meat showed significant difference (P<0.05) in aroma colour and tenderness among all sensory variables measured. Significant difference (P<0.05) were observed on all parameters investigated on tibia bone mineralization. Highest values of all parameters evaluated were recorded for birds in T_1 (0%SSM) and T_2 (25% SSM) except phosphorus content which had highest value on T_2 (25% SSM) while the least value was recorded from bird on T_5 (100% SSM). Conclusively the inclusion of sesame seed meal in broiler ration was found to be beneficial at 25%.

Keywords:: Toasted sesame seed, sensory evaluation, breast meat, tibia

Description of Problem

The ever increasing cost of livestock feeds coupled with the increase in the cost of animal products such as meat, milk and eggs has motivated animal nutritionist to explore the non-conventional feed ingredients as an alternative means of improving livestock production (1). One of such non-conventional protein source is sesame seed (*Sesamum indicum* L.) Commonly known as Beniseed, which is

one of the cultivated oil seed crops in the world. Beniseed is widely grown in the northern and central parts of Nigeria initially as a minor crop until 1974 when it became one of the major cash earners in many Northern states such as Benue, Gombe, Kastina, Plateau and Yobe as well as the Federal Capital Territory. Sesame meal is an excellent source of protein 47.1% to 52.9% (2) and has amino acid composition similar to that of soybean meal. It is rich in leucine, arginine and methionine but relatively low in lysine. Sesame as a tropical plant is highly valued for its oil, which is exceptionally resistant to rancidity. The relative amount of the oil depends on the variety and quality of seeds (3).The oil is widely used in cooking and in the manufacture of margarine and pharmaceuticals. Sesame seed contains high level of vitamin E (tocopherol) which can help reduce the problem of oxidative rancidity in meat when included in animal diet. Also, sesame is exceptionally rich in beneficial minerals such as Iron, Copper, Magnesium, Manganese and Calcium, Vitamin B_1 (thiamine) and Beta-carotene which is a precursor of vitamin A (4). However, as with most tropical legumes, sesame seeds contains anti-nutritional factor which is known to reduce its nutritive value in poultry feed. Some of these anti-nutritional factors include saponin, tannins, oxalate and phytates. It is therefore necessary for animal nutritionist to device means of reducing these factors before it can be incorporated into animal diets as processing improves its utilization by poultry. Processing methods like soaking, dehulling and roasting has been reported to improve the nutritional and functional properties of plant seeds (5). This study was carried out to evaluate the sensory properties of breast meat sample and the tibia bone retention in broiler chicken fed graded level of toasted sesame seed meal.

Materials and Method

Experimental site

The experiment was conducted at the Poultry unit of the Teaching and Research Farm, University of Ibadan, Ibadan, Oyo state, Nigeria.

Source of Ingredients

The sesame seeds were obtained from Bodija market, Ibadan. The seeds were cleaned to remove all the foreign materials and roasted for about 15minutes in a flat pan over an open by constant stirring, until a golden brownish colour was obtained. The toasted seeds were milled and incorporated into the feed. Five experimental diets were formulated such that toasted sesame was used to replace full fat soybean at 0, 25, 50, 75 and 100% which constitutes Treatment 1(control), 2, 3, 4, and 5 respectively as presented in Table 1 and 2.

Experimental animals and design

One hundred and eighty (180) unsexed day old Arbor acre broiler chicks were used for the study. The chicks were randomly assigned to five dietary treatments with thirty-six (36) chicks per treatment. Each treatment was replicated thrice with twelve (12) chicks per replicate in a completely randomized design. The experiment lasted for a period of eight (8) weeks. Feed and water were provided *ad- libitum* and routine vaccination and medication were

carried out as at when due. At the end of the feeding trial, two birds per replicate were purposively selected and slaughtering for sensory evaluation and mineral retention in Tibia bones.

Sensory evaluation

A nine (9) point hedonic scale using a ten member trained taste panel according to the procedure described by (6) was used for the evaluation of organoleptic properties.

Tibia bone collection

Experimental birds were sacrificed by slaughtering through the jugular veins and the tibia of each bird was removed as drumsticks with flesh intact, labelled and immersed in boiling water (100^0c) for 10mins. After cooking and equilibrium to room temp (27^0 c), the drumsticks were defleshed by hand and air dried for 24hrs at room temperature. The bone ash was determined according to the procedure of (7) after oven-dried at 105^0c for 24hrs and ash in a muffle furnace at 600^0c for 6hrs. The amount of phosphorus (P) and calcium (Ca) in the bone ash were determined through the Beckman DV photospectrometer at 660mm according to (7).

$$\%\,P = \frac{OD \times 0.86 \times 50 \times 100 \times 100}{3 \times 1{,}000{,}000} / \text{bone ash wt (g)}$$

Chemical and Statistical analysis

The test ingredients and meat sample were analysed to determine the dry matter, crude protein, crude fibre, ether extract and ash using methods described by (8) and data obtained were subjected to one way analysis of variance. The analysis was conducted using the general linear modelling procedures (9) and mean differences were separated using Duncan multiple range test of the same package.

Table 1: Gross composition of experimental diet (starter phase) (g kg^{-1})

Ingredients	T_1 0% TSSM	T_2 25% TSSM	T_3 50% TSSM	T_4 75% TSSM	T_5 100% TSSM
Maize	43.00	43.00	43.00	43.00	43.00
Full fat soya (FFS)	40.00	30.00	20.00	10.00	-
TSSM	-	12.80	25.60	38.40	51.20
Fish meal	2.00	2.00	2.00	2.00	2.00
Wheat bran	8.80	6.50	4.70	2.40	0.60
Soybean meal oil	3.00	2.50	1.50	1.00	-
Dicalcium phosphate	1.50	1.50	1.50	1.50	1.50
Oyster shell	1.00	1.00	1.00	1.00	1.00
*Premix	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00	100.00
Calculated analysis					
Crude protein (%)	22.31	21.94	21.65	21.28	20.99
ME (kcal kg^{-1})	3199	3248	3263	3312	3328

*Premix supplies: Kg of diet vitamin A (12,500,000IU) ,Vit D3(2,500,000IU), Vit E(40,000mg), Vit K3(2000mg), Vit B(3000mg), Vit B2(5500mg), Niacin(55,000mg), Calcium Panthothenate (11,500mg), Vit B6(5000mg), Vit B1 2 (25mg), Choline Chloride (500,000mg), Folic acid(1000mg), Biotin (80mg) Mn(120,000mg), Fe(100,000mg), Zn(80000mg), Cu(8500mg), I(1500mg), Co(300mg), Se(120mg) TSSM: Toasted Sesame Seed Meal. ME: Metabolizable energy

Table 2: Gross Composition o f Experimental Diet (Finisher phase) (g kg $^{-1}$)

Ingredients	T_1 0%TSSM	T_2 25%TSSM	T_3 50%TSSM	T_4 75%TSSM	T_5 100%TSSM
Maize	45.00	45.00	45.00	45.00	45.00
Full fat soya(FFS)	35.00	26.25	17.50	8.75	-
TSSM	-	11.2	22.40	33.60	44.80
Fish meal	1.00	1.00	1.00	1.00	1.0
Wheat bran	12.80	10.85	9.40	7.45	6.00
Soybean meal oil	3.00	2.50	1.50	1.50	-
Dicalcium phosphate	1.50	1.50	1.50	1.50	1.50
Oyster shell	1.00	1.00	1.00	1.00	1.00
*Premix	0.25	0.25	0.25	1.00	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10
Total	**100**	**100**	**100**	**100**	**100**
Calculated analysis					
Crude protein (%)	20.52	20.21	19.97	19.97	19.42
ME (kcal kg^{-1})	3119.00	3158.00	3163.00	3201.00	3206.00

*Premix suppl ies: Kg of diet vitamin A (12,500,000IU) ,Vit D3(2,500,000IU), Vit E(40,000mg), Vit K3(2000mg), Vit B(3000mg), Vit B2(5500mg), Niacin(55,000mg), Calcium Panthothenate (11,500mg), Vit B6(5000mg), Vit B12 (25mg), Choline Chloride (500,000mg), Folic acid(1000 mg), Biotin (80mg) Mn(120,000mg), Fe(100,000mg), Zn(80000mg), Cu(8500mg), I(1500mg), Co(300mg), Se(120mg) TSSM: Toasted Sesame Seed Meal. ME: Metabolizable energy

Results and Discussion

Results of the proximate composition of meat sample of birds fed diet containing graded levels of TSSM is presented in Table 3. Data obtained showed significant ($P < 0.05$) difference in moisture, protein, ether extract and cholesterol across the dietary treatments except the ash content. Meat sample from birds on T_5 had the highest (72.73%) moisture content while those from T_4 had the lowest (70.90%) value. The protein content recorded ranged (19.63-20.80%) with T_1 having the highest (20.80%) value while T_5 had the lowest (19.63%) value. Results obtained for ether extract revealed that T_2, T_3 and T_4 had similar values which were significantly ($p<0.05$) higher than the values obtained for T_1 and T_5 which were statistically similar. Cholesterol content varied significantly across the dietary treatment in which birds on T_1 (2.57), T_3 (2.55) and T_4 (2.58) recorded similar ($p>0.05$) values but however higher ($p<0.05$) than those on T_2 (2.33) and T_5 (1.88 %) respectively.

Table 3: Proximate composition of meat sample of birds fed diet containing graded levels of TSSM

Parameters (%)	T_1 0%TSSM	T_2 25%TSSM	T_3 50%TSSM	T_4 75%TSSM	T_5 100%TSSM	SEM
Moisture Content	71.22^{bc}	71.62^{b}	71.08^{bc}	70.90^{c}	72.73^{a}	0.09
Protein	20.80^{a}	20.33^{c}	20.57^{b}	20.68^{ab}	19.63^{d}	0.04
Ether extract	5.98^{b}	6.38^{a}	6.35^{a}	6.27^{a}	6.03^{b}	0.03
Ash	2.00	2.00	2.00	2.15	2.35	0.17
Cholesterol(μ/100g)	2.57^{a}	2.33^{b}	2.55^{a}	2.58^{a}	1.88^{c}	0.01

^{abc}Means in the same row with different superscripts are significantly ($P < 0.05$) different
TSSM– Toasted sesame seed meal

Presented in Table 4 is the Sensory evaluation of the breast muscle of birds fed diet containing graded levels of TSSM. There were significant (P<0.05) difference in all the sensory variables observed in this study except the juiciness. The panelist ratings for colour ranged (5.84 – 7.11) with T_1 having the highest (7.11) score while T_5 had the lowest (5.84) score.The highest value for flavour was recorded on T_4 (6.03) and the least value was obtained on T_5 (3.87). According to the panellists rating, the most tender meat was given to T_3 (6.45) while the toughest was recorded on T_1, T_2 and T_5 respectively. No significant (P > 0.05) value was obtained for juiciness across the treatment. The overall acceptability given by the panellist showed that T_1, T_2 and T_3 had the highest acceptability compared with T_1 which have the lowest.

Table 4: Sensory evaluation of breast muscle of birds fed diet containing graded levels of TSSM

Parameters	T_1 0%TSSM	T_2 25%TSSM	T_3 50%TSSM	T_4 75%TSSM	T_5 100%TSSM	SEM
Aroma	4.62^{a}	3.95^{bc}	4.11^{ab}	3.50^{bc}	3.34^{c}	0.34
Colour	7.11^{a}	7.11^{a}	6.61^{ab}	6.50^{ab}	5.84^{b}	0.17
Flavour	4.89^{b}	5.00^{ab}	5.22^{ab}	6.03^{a}	3.87^{c}	0.24
Juiciness	5.56	5.17	5.61	5.11	4.62	0.06
Tenderness	5.44^{b}	5.67^{b}	6.45^{a}	6.00^{ab}	5.39^{b}	0.17
Overall	6.34^{a}	6.22^{a}	6.22^{a}	5.67^{ab}	5.17^{b}	0.28

^{a,b,c}Means in the same row with different superscripts are significantly (P < 0.05) different
TSSM- Toasted sesame seed meal.

Presented in Table 5 is the Sensory evaluation of the thigh meat sample of birds fed diet containing graded levels of TSSM. There were significant (P<0.05) difference in some of the sensory variables evaluated in this study except flavour, juiciness and overall acceptability. The panelist ratings for aroma ranges from (3.36- 4.78) with T_3 (50% TSSM) having the highest score of 4.78 followed by T_1 (4.06) and T_4 (4.11) while the least scores were recorded in T_2 (3.36) and T_5 (3.41) respectively. Highest significant (P<0.05) values for colour were obtained in T_1 (6.06), T_3 (6.00) and T_4 (5.78), followed by T_2 (5.57) while the least value was recorded in T_5 (5.00). No significant (P>0.05) difference obtained for flavour and juiciness across the treatment mean. Birds in T_5 (100%TSSM) had the most tender meat according to the panelist ratings while the toughest was recorded on T_4 (75% TSSM). However, there was no significant (P>0.05) difference in overall acceptability of the meat sample as recorded by the taste panelist.

Table 5: Sensory evaluation of Thigh meat sample of birds fed diet containing graded levels of TSSM

Parameters	T1 0%TSSM	T2 25%TSSM	T3 50%TSSM	T4 75%TSSM	T5 100%TSSM	SEM±
Aroma	4.06^{ab}	3.36^{b}	4.78^{a}	4.11^{ab}	3.41^{b}	0.20
Colour	6.06^{a}	5.57^{ab}	6.00^{a}	5.78^{a}	5.00^{b}	0.14
Flavour	4.70	5.17	5.34	5.45	4.89	0.13
Juiciness	5.56	5.15	5.64	5.67	5.34	0.14
Tenderness	6.17^{ab}	6.29^{ab}	6.17^{ab}	5.72^{b}	6.73^{a}	0.14
Overall	6.11	6.29	6.45	5.97	6.17	0.12

^{a,b,c}Means in the same row with different superscripts are significantly (P < 0.05) different
TSSM- Toasted sesame seed meal.

Indicated in Table 6 is the tibia bone mineralization analysis of birds fed diet containing graded levels of TSSM. There were significant differences ($P < 0.05$) on all parameters of interest observed. Highest tibia weight was recorded for birds in T_1 and T_2 which had similar value but significantly higher than those on T_4, T_3 and T_5 respectively. Length (cm), Calcium (%) and Ash (%) followed a similar trend of variation as observed in weight. Phosphorus content varied significantly across the dietary treatment in which birds in T_2 (22.25) recorded the highest value and the least value was observed in T_5(15.72).

Table 6: Tibi a bone mineralization analysis of birds fed diet containing graded levels of TSSM

Parameters	T_1 0%TSSM	T_2 25%TSSM	T_3 50%TSSM	T_4 75%TSSM	T_5 100%TSSM	± SEM
Weight (g)	12.95^{a}	11.40^{a}	6.27^{bc}	7.58^{b}	4.02^{c}	0.94
Length (cm)	9.73^{a}	9.87^{a}	9.30^{b}	8.70^{c}	7.10^{d}	0.27
Calcium (%)	33.85^{a}	34.57^{a}	31.98^{ab}	30.83^{b}	23.62^{c}	0.72
Phosphorus (%)	21.35^{ab}	22.25^{a}	20.73^{ab}	20.05^{b}	15.72^{c}	0.41
Ash (%)	64.12^{a}	64.18^{a}	63.43^{b}	62.73^{c}	61.57^{d}	0.18

^{a,b,c}Means in the same row with different superscripts are significantly ($P < 0.05$) different
TSSM – Toasted sesame seed meal

Discussion

The lower values of ether extract and cholesterol content observed in T_5 (100% TSSM) could be attributed to the presence of phytosterol in sesame seeds meal and this is a precursor of cholesterol indicating that the consumption of such meat cannot pose any health threat on the final consumer (4). The protein and moisture content values of meat samples obtained in this study were comparable with the standard values as reported by (8). Colour is the first criterion consumers' use to judge meat quality and acceptability (10). Meat colour is influenced by myoglobin content and nature, composition and physical state of muscles and the meat structure (11). The ratings of the taste panellists in this study indicated highest significant values for colour in T_1 (7.11) and T_2 (7.11) while the least score was observed in T_5 (5.84) for breast muscle.Colour of the meat samples decreased across the dietary treatments as the inclusion levels of TSSM increased as observed by the taste panellists. However the juiceness of the meat sample observed in this study was not significantly different across the dietary treatments. The result obtained in this study indicated that TSSM based diet did not signficantly influence the accumulation of abdominal fat of broiler chicken (12).Tenderness has also been identified as the most critical eating quality which determines whether consumers will be convinced to buy more. (13; 14) reported that consumers prefer to pay a premium for high quality product. It is regarded as the most important sensory attribute affecting meat acceptability (15). Based on this study, panellists ratings showed that breast muscle obtained from birds in T_3 (50%TSSM) was the most tender meat while the toughest meats were obtained from birds in T_1 (0%TSSM), T_2 (25%TSSM) and T_5 (100%TSSM) respectively but reverse is the case for

thigh meat sample in which T_5 (100% TSSM) had the highest value of 6.73 and the least was recorded in T_4 (75% TSSM). This showed the dietary effect of sesame seed meal in tenderizing the meat sample. Juiciness of meat is directly related to the intramuscular lipid and moisture content of the meat (16). The combination of water with melted lipid constitute a broth which when retained in meat is released upon chewing. Juiciness is made up of two factors viz a viz the impression of moisture released during chewing and also the salivation produced by flavour (17). Although, the TSSM based diet did not significantly influence the juiciness of the broiler breast muscle and thigh meat sample in this study. The Calcium (Ca) and Phosphorus (P) are the two important minerals in the body that coexist in many biological functions; hence, the dietary needs for these minerals are interdependent (18). Moreso, Ca and P levels have been noted to enhance growth and skeletal mineralization in poultry as well as their ratios availability in the diet. The lowest ($P<0.05$) values of Ca, P and ash content obtained in T_5 could be attributed tonutrient locked-up due to the presence of anti-nutritional factors of the seed which subsequently resulted in reduced intake by the birds. It was evident that both the Ca and P are not free and thus cannot be used by the birds (19)

Conclusion and Application

1. This study showed that 25% inclusion level of toasted sesame meal as partial replacement for full fat soybean effectively enhanced the performance of the birds in terms of the parameters measured.
2. Toasted sesame seed can be supplemented by feed enzymes or be improved by the method of processing the seed so as to reduce the anti-nutrients content in order to break the nutrient lock-up for better utilization.

References

1. Ani, A.O and Omoeje, O. D (2007). Effect of enzyme supplementation of raw bambara groundnut waste diet on nutrient utilization of broiler finisher. *Proceeding of 33rd Annual Conference of NSAP*, Ogun, Nigeria. Pp. 424.
2. Kaneko, K. K., Yamasaki, Y., Tagawa, M. T. and Furuse, M. (2002). Effects of dietary sesame meal on growth, meat ingredient and lipid accumulation in broilers. *Journal of Poultry. Science,* 39:151-162.
3. RMRDC (2004). Survey report of ten selected agro-raw materials in Nigeria. Raw materials Research and Development Council. October. 1-4
4. John, R.O (2009). The enzymatic synthesis of coenzyme A DOI:10.1111./j1753-4887.1954tb03173.x. *Nutrition Reviews.* 12(11). 346-348.
5. Yagoub, A.A and Abdalla, A. A (2007). Effect of domestic processing methods on chemical, *in vitro* digestibility of protein and starch and functional properties of bambara ground nut (*Voandzella subterranean*) Seed. *Research Journal of Agriculture and Biological Science.* 3: 24-34
6. Omojola, A.B. (2007). Performance and carcass characteristics of

broilers chickens fed diet supplements with graded levels of Roxazyme G-AA, *International Journal of Poultry science,* 6(5): 335 -339

7. AOAC (1980). Method of analysis 3rd edition. Association of Official Analytical chemist, Washington DC, USA.
8. AOAC (1995). Method of analysis 12rd edition. Association of Official Analytical chemist, Washington DC, USA.
9. SAS, (1995). SAS/STAT User's Guide (release 6.03) Statistical Institute Carry, North Carolina.
10. Conforth, D. (1994). Colour: its basis and importance. In (eds) Pearson, A.M and Dutson, T.R. Quality attributes and their measurement in meat, poultry and fish products. Advances in meat Research Series, Glasgow Blackie Academic and Professional. Pp. 33-77.
11. Giddings, G. G. (1977). Symposia: The basis for quality in muscle foods, the basis for colour in muscle foods. *Journal Food Science* 4: 288-297.
12. Adetola, O. O., Sajo, A. P., Ogunwole, O. A. and Omojola, A.O. (2012). Growth, Carcass Characteristics and Organ Weights of Broiler Chicken fed Toasted Sesame seed (*sesamum indicum, Linn*) Based diets. Held at International Conference centre, Opp. Radio House, Area 8, Abuja. *Proc. 17th Ann. Conf. Animal Science Association of Nigeria* Pp: 500-502.
13. Koohmarate, M., Wheeler, T. L. and Shackelford, S. D. (1996). Beef tenderness regulation and prediction. In: Processing of International Livestock Congress, Houston, Texas Pp. 25-27.
14. Dransfield, E. (1997). Beef – What price for tenderness? *Meat International* 7: 24-26.
15. Quail, A. (1990). Post-mortem changes in muscle tissue. *S. Muscle Foods* 1: 129-134.
16. Cross, H. R., Savell, J. W. and Francis, J. J. (1986). National consumer retail beef study. In *Proceedings of 38th Annual Reciprocal Meat Conference*, 39: 112-114
17. Omojola, A. B., Isah, O. A., Adewumi, M. K., Ogunsola, O. O. and Attah, S. (2003). Evaluation of the effect of various additives on the acceptability of Kilishi. Tropical *Journal of Animal Science,* 6: 97-101.
18. Rama Rao, S.V., Raju, M.V.L.N., Reddy, M. R. and Pavani, P. (2006). Interaction between dietary calcium and non-phytate phosphorus levels on growth, bone mineralization and mineral excretion in commercial broilers. *Journal of Animal Feeds Science and Technology,* 131: 133-148.
19. Fox, B. A. And Cameroon, A. G. (1980). *Food Science: A chemical Approach*. Hodder and Stoughton Publishers, U.S.A. pp: 40-73