Wayamba Journal of Animal Science – ISSN: 2012-578X; P1641- P1647, 2018
First Submitted March 12, 2018; Number 1519407208

RESPONSE OF FINISHER BROILERS FED TOASTED COTTON SEED CAKE MEAL BASED DIETS

Tamburawa Mu'azu S.[1]*, Zango Muhammad H.[1], Khaleel Aliyu G.[1] and Makinde Olayinka J.[2]
[1]Animal Science Department, Kano University of Science and Technology, Wudil, Nigeria; [2]Animal Science Department, Federal University, Gashua, Nigeria

Corresponding author:- muazutambura@gmail.com

A feeding trial was conducted to determine the growth response, haematological indices and nutrients digestibility of finisher broilers fed diets containing varying levels of toasted cotton seed cake meal (TCSCM). A total of ninety of 4 weeks old broiler chickens (Anak Strain) were used for the experiment. Five diets were formulated such that TCSCM was included at graded levels 0, 7.5, 15, 22.5 and 30 % dietary levels designated as treatment 1, 2, 3, 4, and 5 respectively. The experiment lasted 4 weeks (Finisher phase). The results of the growth performance showed that there were significant differences (P<0.05) in the final body weight (1726.33 – 2121.11g) and daily weight gain (31.00 – 45.06g) with treatments 3 having the highest value among the treatments. Haematological results showed that there were significant differences (P<0.05) in packed cell volume and heterophils. Packed cell volume and Total protein values were higher among birds fed Treatment 3 and 4 (29.00 % and 3.77 g/dl respectively). The results of digestibility of nutrients showed there were significant differences (P<0.05) in the dry matter, crude protein, ether extract and nitrogen free extract digestibilities. Dry matter and crude protein digestibilities were highest among birds fed 15 % TCSCM diet (89.04 and 82.30) compared to those fed other diets. Ether extract and nitrogen free extract digestibilities were significantly (P<0.05) higher in Treatment 3 (15% TCSCM diet). Based on the result of this study, it was concluded that 15 % toasted cotton seed cake can be utilized in the diet of finisher broilers without any depression in growth, haematological parameters and nutrients digestibility with concomitant reduction in the cost of production.

Keywords: broilers, toasted cotton seed cake, growth, haematology, nutrient digestibility

Poultry production is one of the most efficient means of converting plant materials into animal protein (Ihenkuwumere and Herbert, 2003). However, high cost of feed ingredients relative to feed consumption has scared some interested farmers from investing fully in poultry production (Musa *et al.* 2008). According to National Research Council (1991), the production of affordable animal protein require a holistic approach involving feeding of animals with alternative feedstuffs which are cheaper and not competed with human being. The shortage of animal protein intake among the ever increasing human population in the third world countries has long been recognized (Omoikhoje *et al.* 2008). Nigeria like many developing countries of the world has protein deficiency gap, especially that of high quality animal protein. Hence, there is need to seek alternative plant protein sources for poultry feed (Karsin *et al.*, 2008).

Research into the use of cheaper industrial by-products and wastes at various levels of dietary inclusion has been intensified to determine the efficiency of utilization in terms of growth and production. Ungwu (2007) suggested that one of the means of increasing animal protein production was through the use of cheap and readily available agro– industrial by–products in the diet of livestock and poultry. Cotton seed cake is a by-product of the textile industry which is in abundance yet its utilization as feed ingredients for poultry is limited due to gossypol (anti-nutrients) content. Cotton seed cake has shown to be a promising plant

protein that can substitute the conventional feed ingredients (Adeyemo and Longe, 2007).

The issue of gossypol has constituted the greatest problem to the use of cotton seed meal in animal production. This is because the gossypol, a toxic phenolic compound has an inhibiting action on the enzymes pepsin and trypsin in the alimentary tract and this interferes with protein digestion (Tyani *et al.*, 1986). According to Njike (1977), cotton seed cake is the residue obtained after the extraction of oil from cotton seed and the product is ground resulting in flakes. It is produced in commercial quantity in Nigeria and it is relatively cheap. Cotton seeds cake contains 36.15 % crude protein, 19.96 % crude fiber and 14.42 % ether extract**.** The protein of cotton seed meal was found to be low in cystine, methionine and lysine (Nzekwe and Olomu, 1982). Therefore, this study was designed to evaluate the effect of toasted cotton seed cake meal on the growth performance, haematological profile and nutrients digestibility of finisher broilers.

MATERIALS AND METHODS

Experimental Site

The experiment was conducted at Teaching and Research Farm of the Department of Animal Science, Faculty of Agriculture and Agricultural Technology, Kano University of Science and Technology, Wudil. It is located within Sudan savannah region of northern Nigeria. The farm is located on latitude 11^0 37'N and longitude 8^0 58'E at an altitude of 403m above the sea level. The annual rainfall ranges from 850mm to 870mm (Olofin *et al.*, 2008).

Management of Experimental Birds

A total of Ninety 4-week old broilers were used for this study. The birds were carefully raised in deep litter house which was partitioned into pens with wooden frame and wire mash. The birds were weighed and randomly allocated into pens. Feed and water were provided *ad libitum*. Adequate and proper ventilation as well as sufficient light and optimum temperature were ensured as described by Oluyemi and Roberts (2000). The mortality records were monitored as the experiment progresses. Health management such as cleaning of the house and checking of the physical condition of birds were done daily. The birds were also vaccinated against Newcastle disease at five weeks of age. Antibiotic such as Embazine forte and Oxyteracycline soluble powder were given to birds at five weeks of age.

Experimental Diets and Design

Five broiler finisher diets were formulated using toasted cotton seed cake meal at graded levels of 0, 7.5, 15, 22.5, and 30 %. The diets were designated as Treatments 1, 2, 3, 4 and 5 respectively (Table 2). The Sample of toasted cotton seed cake meal was chemically analyzed in the laboratory for proximate composition according to A.O.A.C. (1990) (Table 1). The treatments were assigned and allotted to birds in completely randomized design (CRD). Each treatment was replicated thrice with 6 birds per replicate.

Table 1: Proximate Composition of toasted cotton seed cake meal

Components (%)	Toasted cotton seed cake meal
Dry matter	92.29
Crude protein	31.56
Ether extract	5.23
Crude fibre	13.32
Ash	2.43
Nitrogen free extract	47.46

Data Collection

The birds were initially weighed at the beginning of the study and reweighed on weekly basis to determine the weekly weight gain. The feed offered daily and left over of feed were weighed daily using a 10kg weighing scale and the feed consumption was determined by subtracting the daily left-over from the daily feed offered. The final live weight was also recorded at the end of the experiment. The feed conversion ratio was calculated as ratio of daily feed consumed per unit weight gain. Similarly, the cost per kilogram gain of birds was also calculated.

Blood samples were collected at week eight (8) via the wing vein to determine the effect of the diets on blood composition. A bottle containing an anticoagulant ethylene diamine tetra-acetic acid (EDTA) was used for blood sampling. The blood samples were

Table 2: Composition of broiler finisher diets containing toasted cotton seed cake meal

Treatments					
Ingredients	T1 (0%)	T2 (7.5%)	T3 (15%)	T4 (22.5%)	T5 (30%)
Maize	64.01	63.20	60.05	60.00	55.00
Soya bean meal	22.49	15.80	11.65	4.00	1.50
Toasted cotton seed cake meal	0.00	7.50	15.00	22.50	30.00
Fish meal	3.50	3.50	3.50	3.50	3.50
Wheat offal	6.00	6.00	6.00	6.00	6.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Salt	0.30	0.30	0.30	0.30	0.30
Lysine	0.25	0.25	0.25	0.25	0.25
Methionine	0.20	0.20	0.20	0.20	0.20
Vitamin-premix	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100
Calculated Analysis					
Crude protein (%)	20.00	20.00	20.00	20.00	20.00
Metabolisable Energy, Kcal/kg	3108	3074	3038	3005	3000
Crude fibre (%)	3.04	4.69	5.70	5.92	5.20
Ether extract (%)	5.07	5.18	5.60	4.61	4.99
Ash (%)	2.85	3.03	3.29	3.46	3.78
Calcium (%)	1.37	1.38	1.38	1.39	1.39
Phosphorous (%)	0.93	0.96	0.98	0.99	0.99
Lysine (%)	1.24	1.15	1.12	1.11	1.04
Methionine (%)	0.58	0.64	0.71	0.77	0.84

*Premix supplied per kg of diet:Vit A, 10,000 IU; Vit D, 2,8000 IU; Vit E, 35,000 IU; Vit K, 1,900 mg; Vit B_{12} 19 mg Riboflavin, 7,000 mg; Pyridoxine, 3,800 mg; Thiamine, 2,200 mg; D – Pantothenic acid, 11,000 mg; Nicotinic acid, 45,000 mg; Folic acid, 1,400 mg; Biotin, 113 mg; Cu, 8,000 mg; Mn, 64,000 mg; Zn, 40,000 mg; Fe, 32,000 mg; Se, 160 mg; Iodine, 800 mg; Cobalt, 400 mg; Choline, 475,000 mg; Methionine, 50,000 mg; BHT, 5,000 mg; Spiramycin, 5,000mg.

put in an ice packed and transported to the Faculty of Veterinary Medicine, haematology laboratory of the Ahmadu Bello University, Zaria for examination and determination of packed cell volume, red blood cell, white blood cell and its differential components. Haemoglobin was also determined.

A digestibility trial was carried out at the end of the finisher phase in which 3 birds per replicate were fed the experimental diets. A known quantity of feed was offered to birds daily and the leftover feed was also weighed to determine the amount consumed by each bird. The sample of diets and droppings from birds were conveyed and analyzed in the laboratory for proximate composition as described by A.O.A.C. (1990). Apparent nutrient digestibility of dry matter, crude protein, ether extract, crude fibre, ash and nitrogen free extract were determined using the following equation:

$$\% \text{ Apparent nutrient digestibility} = \frac{\text{Nutrient intake} - \text{Nutrient output}}{\text{Nutrient intake}} \times 100$$

Data Analysis

Data generated was subjected to Analysis of variance (ANOVA) using the general linear model in a statistical analysis system (SAS, 2002).

Statistical model used was $Y_{ij} = \mu + Pi + eij$, Where:

Y_{ij} = the j^{th} observation of the i^{th} processing of cotton seed cake by toasting

μ = the overall estimate of the population means.

P_i = the effect of the i^{th} processed cotton seed cake inclusion in T1, T2, T3, T4 and T5

E_{ij} = the random error.

RESULTS AND DISCUSSION

The results of growth performance of broiler chickens fed graded levels of toasted cotton

Table 3: Growth performance of broiler chickens fed graded levels of toasted cotton seed cake meal based diets.

Treatments						
Parameters	T1 (0%)	T2 (7.5%)	T3 (15%)	T4 (22.5%)	T5 (30%)	SEM
Initial body weight (g)	911.33	910.34	910.35	910.44	911.46	5.12^{NS}
Final body Weight(g)	2013.33^{ab}	1907.78^{abc}	2121.11^{a}	1821.11^{bc}	1726.33^{c}	68.54^{*}
Daily weight Gain (g)	41.25^{ab}	37.50^{abc}	45.06^{a}	34.43^{bc}	31.00^{c}	2.45^{*}
Daily feed Intake (g)	157.35^{ab}	160.39^{a}	156.15^{ab}	150.26^{ab}	146.40^{b}	3.67^{*}
Feed conversion ratio	3.83^{ab}	4.32^{b}	3.47^{a}	4.69^{b}	4.77^{b}	0.33^{*}
Feed Cost, ₦/kg gain	317.00^{b}	350.42^{c}	276.30^{a}	348.30^{c}	363.63^{c}	26.16^{*}
Mortality rate (%)	0.33	0.00	2.78	0.00	0.33	1.25^{NS}

^{abc}= Means with different super scripts on the same row are significantly different (P<0.05). SEM=Standard Error of Means. NS=Not Significant.

seed cake meal based diets is presented in Table 3. The results showed that there were significant differences (p<0.05) in the final body weight, daily weight gain and daily feed consumed. Birds fed diet T3 had highest value (2121.11g) compared to those other diets. Broilers fed T3 diet had significantly (p<0.05) higher daily weight gain (45.06g), while those fed diet T5 had the lowest value of daily weight gain (31.00g). The improved performance observed among birds fed 15 %TCSCM diets in terms of body weight gain, feed intake and feed conversion ratio suggests that there was enhanced availability, digestion, absorption and utilization of the nutrients by the birds.

Adeyemo and Longe (2007) had earlier reported that feeding cotton seed cake diets increase weight gain of broiler chickens. Akanji *et al.* (2003) reported that toasting of legume grains improved the performance of broiler chickens. Significant differences (p<0.05) were observed in daily feed intake, feed conversion ratio and feed cost per kilogram gain (₦/kg gain). The feed consumption tends to reduce as the level of inclusion TCSCM increased beyond 15%. This may be attributed to high fibre content of cotton seed cake (13.32 %). Starling et al. (2002) reported that there may be corresponding increase in fibre content of the diet as the inclusion level of dietary toasted cotton seed cake increased in the diets. Also, McDonald *et al.* (1995) reported a reduction in daily feed intake as the level of cotton seed meal inclusion increased in the diets of pig and poultry. The reduction in the daily feed intake was attributed to the presence of residual gossypol in the test ingredient (Randel *et al.*, 1992). Akanji (2003) had earlier reported that processing improves utilization of oil seed cakes by preventing formation of protein–iron complexes that may inhibit the digestion of protein. The various levels of toasted cotton seed cake meal in the diets had no significant (p>0.05) effect on mortality rate of the birds.

The results of hematological parameters of broilers fed TCSCM based diets are presented in table 4. The results showed that there were no significant differences (p>0.05) in all the parameters measured except packed cell volume and heterophils counts (p<0.05). The Packed cell volume (PCV) was highest (29.00 %) among birds fed T3 diet and significantly (p<0.05) higher than those fed other diets. The heterophils counts were significantly (p<0.05) highest among birds fed T2 diet (15.00 %) while the lowest value was observed among birds fed T3 diet (8.00 %). The values were slightly above the normal range reported by Olorode *et al.* (1996).

These differences may be attributed to the inhibition of protein utilization by the birds. The values of RBC obtained fall within the normal range reported by Mitruka and Rawnsely (1977) and Olorode *et al.* (1996). Adejinmi *et al.* (2000) however reported inconsistent RBC values for broilers fed varying levels of soldier fly larvae meal diets. This suggests that TCSCM based diet did not inhibit haemopoiesis as would have been the case if the gossypol had inhibited

Table 4: Haematological Profiles of broiler chickens fed graded levels of toasted cotton seed cake meal based diets.

Treatments						
Parameters	1 (0%)	2 (7.5%)	3 (15%)	4 (22.5%)	5 (30%)	SEM
Packed cell volume (%)	27.01^{b}	25.00^{c}	29.00^{a}	23.00^{c}	27.00^{b}	0.58^{***}
Haemoglobin (g/dl)	9.00	9.00	9.37	9.00	8.03	0.50^{NS}
Red blood cells($x10^6$/l)	4.50	4.00	3.70	4.40	4.40	0.31^{NS}
White blood cells($x10^3$/mm)	3.33	3.20	4.01	2.72	3.06	0.53^{NS}
Heterophils (%)	10.00^{bc}	15.00^{a}	8.00^{c}	10.67^{b}	13.00^{a}	0.65^{***}
Lymphocyte (%)	64.00	60.00	65.00	59.67	55.00	3.00^{NS}
Monocyte (%)	2.63	2.36	2.82	3.03	2.75	0.60^{NS}
Eosinophils (%)	1.99	1.96	2.04	1.74	2.29	0.28^{NS}
Basophils (%)	3.26	3.22	2.50	2.94	3.14	0.79^{NS}

^{abc}= Means with different super scripts on the same row are significantly different (P<0.05). SEM=Standard Error of Means. NS=Not Significant.

Table 5: Digestibility of nutrients by broiler chickens fed graded levels of toasted cottonseed cake meal based diets

Treatments						
Parameters	1 (0%)	2 (7.5%)	3 (15%)	4 (22.5%)	5 (30%)	SEM
Dry matter (%)	82.14^{bc}	85.97^{ab}	89.04^{a}	84.56^{ab}	76.37^{c}	2.01^{*}
Crude protein (%)	77.78^{a}	77.34^{a}	82.30^{a}	66.76^{b}	58.58^{b}	2.89^{**}
Crude fibre (%)	58.65	53.93	55.04	53.77	53.39	1.97^{NS}
Ether extract (%)	83.21^{a}	67.24^{b}	65.67^{b}	58.56^{b}	61.60^{b}	3.19^{**}
Ash (%)	61.68	72.89	58.90	66.79	73.74	5.47^{NS}
Nitrogen free extract (%)	73.63^{ab}	63.86^{b}	80.48^{a}	71.92^{b}	74.62^{ab}	3.51^{*}

^{abc}= Means with different super scripts on the same row are significantly different (P<0.05). SEM=Standard Error of Means. NS=Not Significant.

protein digestion. White blood cells value for the birds fed TCSCM based diets followed the same pattern as RBC. The leucocytes values were not significantly different from each other. This shows that the birds ability to fight disease invasion, phagocytosis was not impaired by the diets. The values for the differential counts (lymphocytes, monocytes and basophils) were not significantly (p>0.05) affected by the dietary utilization of toasted cotton seed cake meal among the birds. These granulocytes are responsible for providing the body with a defense against invading microorganisms. They are attracted in large number to any area of the body which has been invaded by microorganisms. This suggests that the birds were not at risk of microbial poisoning or residual anti-nutrients in TCSCM.

The results of nutrient digestibility of broiler chickens fed graded levels TCSCM diets is presented in Table 5. There were significant differences (p<0.05) in all the parameters analyzed except crude fibre and ash (p>0.05). Dry matter digestibility was highest (89.04 %) among birds fed 15 % TCSCM diet and lowest among those fed 30 % TCSCM diet. Crude protein digestibility showed significant differences (p<0.05) with the highest values observed among birds fed T1, T2 and T3 diets (77.78, 77.34 and 82.30 % respectively). The lower values of crude protein digestibility observed among birds fed 25 and 30 % TCSCM diets may be attributed to high fibre content of the diets. Ether extract digestibility value was significantly (p<0.05) higher among birds fed T1 diet (83.21 %) compared to those other diets. This may attributed to the fact the control diet does not contain toasted cotton seed cake meal. Significant differences (p<0.05) was also observed for nitrogen free extract (NFE) digestibility

across the treatment values. Birds fed T1, T3 and T5 had higher NFE values as 73.63, 80.48 and 74.62 % respectively. Although, these values were statistically similar, but numerically the highest percentage was recorded among birds fed T3 diet (80.48%). This difference may be attributed to better retention of soluble carbohydrates in the body of birds fed T3 diet compared to those fed other diets. Ojewola et al. (2006) reported that the level of inclusion of cotton seed meal did not negatively influence utilization of nutrients even at 100% replacement of soya bean meal.

CONCLUSION

Based on the results of this study, it was concluded that toasted cotton seed cake meal can be included as protein source in broiler chicken's diet up to 15% without any depression on growth performance, hematological profile and nutrient digestibility.

REFERENCES

1. A.O.A.C., (1990). Official Methods of Analysis, Association of official Analytical Chemist, Washington DC.423-858.
2. Adejinmi, O.O., Adejinmi, J.O., & Adeleye, O.A. (2000). Studies on the haematology and serum biochemistry of broiler fed varying levels of soldier fly larvae meal diets. *Tropical Animal Production Investigation,* 3,169-179.
3. Adeyemo, G.O., & Longe, O.G. (2007). Effects of graded levels of cotton seed cake on performance, haematology and carcass characteristics of broilers fed from day old to 8 weeks of age. *African Journal of Biotechnology,* 6(8), 1064 – 1071.
4. Akanji, A.M., Ologhobo, A.D., Emiola, L.A., Adedeji, T.A., & Adedeji, O.S. (2003). The effect of processing on haemagglutinin and other anti-nutritional factors in Jackbean (*Canavalia ensiformis*) In: Proceedings of the 28th Annual Conference of Nigerian Society for Animal Production, University of Ibadan, Nigeria, pp 189-193.
5. Ihenkwumere, F.C., & Herbert, U. (2003). Physical responses of broiler chickens to quantitative water restriction. *International Journal of Poultry Sciences,* 9(5), 177.
6. Karsin, P.D., Oyawoye, E.O, Bawa, G.S., Musa, U., & Edoche, J.A. (2008). Performance of Japanese quails fed Graded levels of pigeon pea (*Cajanus cajan*) Meal. In: Proceedings of 33rd Annual Conference of Nigeria Society for Animals Production , March 17th – 20th held at the College of Agricultural Sciences, Olabisi Onabanjo University, Ogun State. Nigeria, Pp 312 – 315.
7. McDonald, P.A., Edward, R.A., & Green halgh, J.F.D. (1995). Animal Nutrition 5th Edition, Longman Group London, Pp 155-160.
8. Mitruka, B.M., & Rawnsley, H.N. (1977). Clinical Biochemical and Haematological Reference values in normal experimental Animals. Masson 2nd edition, New York, 12-15.
9. Musa, R. A., Olarinde, L. O., Adeyemi, O. A., Ogungbean A.M., & Dada, A.O. (2008). Cost and return implications in poultry farming in 20 Local Government Area of Oyo State. In: Proceeding of 33rd Annual Conference of the Nigerian Society for Animal production, March 17th–20th held at the College of Agricultural Sciences, Olabisi Onabanjo University, Ogun State. Pp 215 – 230.
10. Njike, M.C. (1977). The effect of cotton seed meal (CSM), groundnut meal mixture and protein levels in practical broiler diets *Nigerian Journal of Animal production,* 4,81.

11. NRC. (1991). Micro – Livestock, little known small Animals with Promising Economic future, National Academy press Washington DC, Pp 14-16.
12. Nzekwe, N.M., & Olomu, J.M. (1982). The evaluation of cotton seed as a replacement for groundnut meal in broiler rations. *Journal of Animal Production Research*, 2, 123-138.
13. Ojewola, G.S., Ukachukwu, S.N., & Okunlonye, E.I. (2006). Cotton Seed meal as substitute for soya bean meal in broiler Ration. *International Journal of Poultry Science*, 5(4), 360–364.
14. Olofin, E.A., Nabegu, A.B., & Dambazau, M. A. (2008). Wudil within Kano region; A geographical synthesis, 1st edition, Adamu Joji publishers. Department of Geography, KUST Wudil, 32-35.
15. Olorode, B.R., Onifade, A.A., Opara, A.O., & Babatunde G.M. (1996). Growth, nutrient retention, haematology and serum chemistry of broilers fed shea butter or palm kernel cake in the humid tropics. J*ournal of Applied Animal Research*, 10,173 – 180.
16. Oluyemi, J.A., & Roberts F.A. (2000) Poultry production in warm wet climate. Revised edition, Spectrum books Ltd, Ibadan, Nigeria, Pp 244.
17. Omoikhoje, S.O., Bamgbose, A.M., & Aruna, M.B. (2008). Replacement value of unpeeled cassava root meal (UPCRM) for maize in weaner rabbit Diets. *Nigerian Journal of Animal Productio*n, 35, 63-68.
18. Randel, R.D., Chase C.C., & Wyse, S.J. (1992). Effects of gossypol and cotton seed products on reproduction of Mammals. *Journal of Animal Science*, 70, 1628–1638.
19. SAS. (2002). User's Guide Statistics version 6th edition, SAS statistical Package Inc, cary. North Carilina, U.S.A.
20. Starling, K.G., Costa, E.F., Henry, M.T., Pesti, G.M., & Bakalli, R.I. (2002). Responses of broiler chickens to cotton seed and soya bean meal based diets at several protein levels. *Poultry Sciences Journal*, 81, 217–226.
21. Tyani, J.R., Kratzer, F.A., Grats, G.R., & Vohere, P. (1986). Effect of cotton seed cake on laying, breeding hens and broiler chicks. *Poultry Science Journal*, 65, 549–955.
22. Ungwu, V.J. (2007). Utilization of agro–industrial by products (Rice and wheat offals) in the diet of Pigs. In: Proceeding of the 29th Annual Conference of the Nigerian Society of Animals production held at University of Nigeria Nsukka Pp. 28.

