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Performance of broiler finishers fed toasted *Mucuna pruriens* seed meal

*** [1]Akure, C. O., [2]Vantsawa, P.A., [3]Bot, M.H., [1]Ayodele, J.T. and [4]Yasheem, M.S.**

[1]Federal College of Forestry and Mechanization, Afaka, Kaduna,
[2]Department of Biological Sciences, Nigerian Defence Academy, Kaduna
[3]Federal College of Animal Health and Production, Technology, NVRI, Vom, Plateau State
[4]Department of Animal Sciences, Ahmadu Bello University, Zaria, Kaduna State

***Corresponding Author:** akurechristy@yahoo.com **Phone Number:** +2348034962740*

***Target Audience:** Farmers, Industrialists, Researchers*

Abstract

A four-week feeding trial was conducted to evaluate the effect of toasted Mucuna seed meal (TMSM) on the growth performance and the digestibility of nutrients by four week-old broiler finisher chicks. Three hundred and seventy five broiler chicks were randomly allocated to five experimental treatment diets in a completely randomized design (CRD). Each treatment was replicated thrice. TMSM was fed in graded levels of 10.0, 20.0, 30.0, and 40.0% alongside control diet of 0.0 TMSM. The parameters measured and calculated include final bodyweight, weight gain, feed intake, feed to gain ratio and feed cost per kilogram gain. Digestibility of dry matter, crude protein, crude fibre, ether extract, ash and nitrogen free extract were also calculated. The data collected were subjected to analysis of variance (ANOVA). The results showed that the final body weight of birds at 0% and 10%, the weight gain at 0% and 10%, feed intake at 0% and 10% as well as feed to gain ratio at 0% and 10% levels of inclusion of TMSM were statistically (P>0.05) similar and higher than those from other levels of inclusions. Feed cost per kilogram weight gain and feed cost per bird were lower for all TMSM diets when compared to the control diet. Digestibility of nutrients (DM, CP, CF, EE, Ash and NFE) was similar and better for the birds fed the control and 10.0% TMSM. It was concluded that inclusion of TMSM in the diets of broiler finisher chicks up to 10% has beneficial effects.

***Key words:** Broiler chicks; Mucuna pruriens; Digestibility; Graded levels; Performance.*

Description of Problem

About 90% of the protein feedstuffs used in Nigeria for livestock production is in use by man, this brings about a high competition between man and livestock especially poultry in the use of these conventional feed ingredients such as groundnuts and soybean. To address Nigeria's human protein deficit, the animal nutritionist has been in constant search of alternative feed ingredients which are cheaper and in less demand by man so that animal protein can get to the table of an average Nigerian. With this in mind several actions are taken to increase the production of protein crops that could serve as alternatives to the conventional feed ingredients such as soybean and groundnuts. This is because the global demand for livestock products will require increasing amounts of feed protein supplies and sources which usually come with its attendant high cost (1). One of these Non- Conventional Feed (NCF) ingredients identified by animal nutritionist is *Mucuna pruriens* seeds (2). *Mucuna pruriens* seeds is a widely available leguminous seed found in the forest, it

thrives well where others fail due to excellent adaptability to extreme climatic conditions. It yields about three to four tons of seed per hectare. It is a potential source of protein because it has appreciable level of crude protein. It has a crude protein of about 29.89% (2). It possibly has a potential to be used at a higher inclusion level in broiler chicken production. As most plant based protein crops, *mucuna pruriens* seed contain anti-nutritional factors (**ANF**s) that might limit the possible inclusion level in broiler diets. Tannins, haemaglutinnin, Hydrogen cyanide, Saponnins and trypsin inhibitors are ANFs that are associated with velvet beans (3,4). Literature reveals that tannins are known to decrease both protein and energy digestibility. However, some of these ANFs are heat labile. Toasting is one of the processing methods that involve the use of heat to reduce the level of anti-nutritional factors in mucuna seeds, outside boiling. Some authors had used toasting as a processing method (5, 6, 7). Studies by (8) have demonstrated that toasting alone as a method of processing jack bean seeds did not appreciably reduce the level of toxic factors in jack beans, however (9) found dry heat treatment to be the most effective in reducing L-DOPA in *Mucuna* seeds and attributed the reduction to racemization under roasting. (10) showed that roasting of *Mucuna* seeds reduced trypsin inhibitors significantly (raw vs 3o mins roasting; 18.90 vs.1.58 TIU/mg). Both dry heat treatment and autoclaving reduced the phytic acid in the seed of *Mucuna* pruriens (36% and 47%) (9). The cyanide content of *Mucuna* seeds, averaged 18.6 mg/kg in raw seeds was not detected after roasting or dehulling roasted samples, (11) in their work reported 10, 36.36, 45,73, and 100% reduction in L-DOPA, tannin HCN and trypsin inhibitor of *Mucuna solanei* when toasted. This research aims at evaluating the effect of feeding toasted *Mucuna* seed meals on the growth performance and nutrient digestibility when included at different levels in the diet of broiler finishers

Materials and Methods

Experimental site:

The experiment was conducted at the Poultry Section, Department of Livestock, Ministry of Agriculture, Mariri, in Kumbotso Local Government Area of Kano State. The area lies between latitude $11^{o}55'$N and longitude $8^{o}36'$Eat an altitude of 460m above sea level with an average annual rainfall of 600-1000mm, mean temperatures of 21.21^{o}C and humidity of 52.81 %. (12).

Preparation of experimental diets:

250g of the sample of *Mucuna pruries* bean were toasted in an open pan containing about 200g of sand. The pan was placed on fire with sand inside of it and heated for 10minutes. Raw *Mucuna* seeds were poured in the heated sand with constant stirring of seed and sand to have uniform application of heat. The stirring continued for 30 minutes until an aroma like toasted groundnut was perceived. The *Mucuna* seeds was removed from the fire and allowed to cool and the sand separated before milling.

Five experimental diets were formulated. The inclusion levels of toasted Mucuna seed meal were as follows T1- 0% TMSM, T2-10.0% TMSM, T3-20.0% TMSM, T4 -30.0% TMSM, T5 -40% TMSM. The feed composition for the broiler finisher is shown in Table 1.

Table: 1 Gross composition of experimental diet (Broiler finisher) % containing toasted *Mucuna* seed meal (TMSM)

Ingredients (%)	Levels of TMSM, %				
	0	10.00	20.00	30.00	40.00
Maize	54.05	50.80	46.95	38.00	31.25
Groundnut cake	27.00	20.25	15.10	13.05	9.80
Mucuna seed meal	0.00	10.00	20.00	30.00	40.0
Soybean meal	9.00	9.00	9.00	9.00	9.00
Maize offal	5.00	5.00	5.00	5.00	5.00
Fish meal (local)	2.00	2.00	2.00	2.00	2.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Limestone	1.00	1.00	1.00	1.00	1.00
Common salt	0.30	0.30	0.30	0.30	0.30
Methionine	0.30	0.30	0.30	0.30	0.30
Lysine	0.10	0.10	0.10	0.10	0.10
*Vitamin/trace min.premix	0.25	0.25	0.25	0.25	0.25
Total	**100**	**100**	**100**	**100**	**100**
Calculated Analysis (%)					
ME (Kcal/kg)	3001	3000	3112	3020	3025
Crude Protein	20.00	20.00	20.00	20.00	20.00
Crude fibre	4.35	4.78	6.46	7.85	7.95.
Ether Extract	7.80	7.92	7.45	7.00	6.95
Ash	6.40	6.45	6.40	6.42	6.35
Calcium	1.25	1.29	1.27	1.28	1.29
Available Phosphorus	0.78	0.79	0.70	0.74	0.74
Lysine	1.20	1.22	1.24	1.20	1.22
Methionine	0.57	0.59	0.51	0.57	0.58
Methionine + Cystine	0.75	0.72	0.70	0.72	0.70
Cost/kg diet (₦)	171.15	168.22	167.45	163.75	160.50

*Biomix Premix supplied per kg of diet: Vit. A, 10000 I.U; Vit.D_3, 2000 I.U; Vit.E, 23mg; Vit.K, 2mg; Vit.B1 (Thiamine), 1.8mg; Vit.B2 (Riboflavin), 5.5mg; Vit. B6 (Pyridoxine), 3.0mg; Vit B12, 0.015mg; Pantothenic acid, 7.5mg; Folic acid, 0.75mg; Niacin, 27.5mg; Biotin, 0.06mg; Choline chloride, 300mg; Cobalt, 0.2mg; Copper, 3mg; Iodine, 1mg; Iron, 20mg; Manganese, 40mg; Selenium, 0.2mg ; Zinc, 30mg; Antioxidant, 1.25mg; I.U; International unit; M.E., Metabolisable Energy.

Management of experimental birds

A total of three hundred (375) four-week old chicks were used for this study. The birds were randomly assigned to pens in a completely randomized design (CRD). There were five treatments and each treatment was replicated three times with twenty five (25) birds per pen which constituted seventy five (75) birds per treatment. The chickens were housed in pens raised from the floor, equipped with solid floor covered with fresh wood shavings. The routine management such as cleaning of in and out of the poultry house was carried out; the management of the birds was carried out according to the standard procedures for brooding, vaccination and medication (13). Birds were supplied with experimental diets and fresh water *ad libitum* throughout the trial period (28 days).

Growth performance study

The growth performance characteristics were measured in terms of weight gain, feed intake, and feed to gain ratio. The birds were weighed at the beginning of the experiment

and allotted into pens in a completely randomized design (CRD). The birds and feed were weighed weekly to calculate the feed intake and the weight gain. The average final weights of the birds were also calculated at the end of the experiment.

Digestibility study

At the end of the experiment the birds were weighed and after the final weighing, three birds per treatment were selected and housed individually, in cages for faecal collection. The birds were allowed to acclimatize for seven days. After the seven days the birds were fasted of feed for twenty four hours, after that the experimental diets were introduced, 100g of feed was supplied daily and water given *ad libitum.* Faecal droppings per bird were collected daily. At the end of collection period (7 days) the faeces for each bird were bulked, thawed, weighed and oven dried at 60^0C for seventy two (72) hours and subjected to proximate analysis(14) Values obtained were then used to calculate the apparent nutrient digestibility.

$$\% \text{ Nutrients Digestibility} = \frac{\text{Nutrient intake - Nutrient voided}}{\text{Nutrient intake}} \times 100$$

Statistical Analysis

Data obtained from the performance and digestibility evaluation were subjected to analysis of variance (ANOVA) using procedure of (15), significant levels of differences among treatment means were determined using the Duncan's multiple range tests.

Results and Discussion

The result of the performance characteristics of boiler finishers fed Mucuna seed meals are shown in Table 2. Significant differences ($p<0.05$) were observed in final weight, weight gained, feed intake and feed to gain ratio. Birds in T1 and T2 recorded the highest significant ($p<0.05$) final weight, weight gained, feed intake and feed to gain ratio, followed by T3 and T4 while the least final weight, weight gained, feed intake and feed to gain ratio were obtained in T5.

The highest significant ($p<0.05$) values for final weight, weight gained, feed intake and feed to gain ratio obtained for birds on treatment T1and T2 which is higher and better than those on T3 to T5 could be an indication that birds on 10%TMSM had sufficient digestible nutrients that were better efficiently utilized than other levels. The reduced feed intake at other higher levels of TMSM could be attributed to the effect of residual anti-nutritional factors which became pronounced as the dietary levels of TMSM increased. The reduced weight gain observed as the dietary level of inclusion increased from 20 to 40% TMSM also could be attributed to the reduced feed intake and poor efficiency of feed conversion and utilization which limited the availability of digestible nutrients. These findings are in agreement with the report of (16) who observed that weight gain in broiler was directly related to feed intake, quality of feed as well as efficiency of feed utilization. There was significant ($P<0.05$) decrease among treatment means for feed cost per bird and cost per kilogram gain, which decreased as the dietary levels of TMSM increased. The feed cost per bird and per kilogram gain were significantly ($P<0.05$) better for all the TMSM diets compared to the control diet. This was because *Mucuna* seeds were cheaper and readily available without much competition from humans as they are not valued as human food.

Table 2: Effects of feeding diets containing toasted *Mucuna* seed meal on performance of Broiler finishers

Measurements	Levels of TMSM(%) 0.0	10.0	20.0	30.0	40.0	SEM
Initial weight (g/bird)	1000.00	1000.00	1000.00	1000.00	1000.00	0.00
Final weight (g/bird)	2400.00[a]	2400.00[a]	2200.67[b]	2000.73[c]	1850.93[d]	5.00
Weight gain (g/bird)	1400.00[a]	1400.00[a]	1200.67[b]	1000.73[c]	850.93[d]	10.45
Feed intake (g/bird)	3200.60[a]	3210.42[a]	3000.42[b]	2800.88[c]	2700.77[d]	38.30
Feed to gain Ratio	2.42[a]	2.46[a]	2.93[b]	3.02[c]	3.17[d]	0.02
Feed cost/kg weight gain (₦)	220.00[e]	200.22[d]	180.58[c]	173.41[b]	155.23[a]	-
Feed cost/bird (₦)	590.44[d]	577.58[c]	575.24[bc]	572.48[b]	566.32[a]	-

[abc]Means within the same row with different superscripts differ significantly (P<0.05) SEM = standard error of means

Table 3 shows the result of the nutrient digestibility by broilers fed diets containing graded levels of TMSM respectively. There were significant (P<0.05) differences among the treatment means for the digestibility of dry matter (DM), crude fibre (CF), ether extract (EE), ash, nitrogen free extract (NFE) and crude protein (CP) retention. The digestibility of all the nutrients were significant (P<0.05) highest and similar for birds fed control and those fed 10% TMSM diets but decreased significantly (P<0.05) as the level of inclusion of boiled *Mucuna* seed meal increased from 20 to 40% levels. The highest digestibility of CP, CF, EE, Ash and NFE were observed in birds fed 10% TMSM diets which were similar to those of birds fed the control diet. This could be due to the fact that the birds digested and utilized the diets containing 10% TMSM efficiently as evidenced by better gain on those diets. Dietary nutrient intake in the diet containing 10% TMSM was higher than those of birds fed higher treatments of TMSM. Hence, the significantly (P<0.05) higher weight gain of the birds fed 0, and 10.0% TMSM diets compared to other levels might have resulted from high nutrient intake and efficient nutrient digestion, absorption and utilization in the diets. The presence of highly digestible carbohydrate may be responsible for the high nutrient intake which resulted in high NFE digestibility in TMSM diets at 0 and 10.0%TMSM.The significant (P<0.05) decrease in nutrient digestion as the dietary inclusion level of TMSM increased could be attributed to low digestible carbohydrate and high residual effect of anti-nutritional factors at high levels of TMSM hence low feed intake recorded. Tannins are known to complex with dietary proteins and bind dietary nutrients thereby reducing efficient digestion of nutrients. They are also known to lower the activity of several digestive enzymes such as trypsin and chymotrypsin.

The decrease in crude fibre digestibility by the broiler chickens as the level of TMSM increased in this study agreed with the findings of (17, 18 &19) that reported significant decrease in crude fibre digestibility with increasing level of fibre in diets. The significantly reduced (p<0.05) ash digestibility by broiler chickens at high levels of TMSM diets could be due to the residual tannin content of the *Mucuna* seed meal, because tannin also complex with minerals especially iron and prevents its absorption.

Table 3: Effects of toasted *Mucuna* seed meal based diets on nutrients digestibility by broiler finishers (%)

Levels of TMS			Levels of	TMSM, %		
Constituents (%)	0.0	10.0	20.0	30.0	40.0	SEM
Dry matter	80.65[a]	80.30[a]	75.56[b]	70.76[c]	70.61[d]	0.14
Crude protein	72.87[a]	72.80[a]	68.80[b]	65.53[c]	60.79[d]	0.03
Crude fibre	58.04[a]	52.82[a]	50.26[b]	47.36[c]	42.36[d]	0.02
Ether extract	78.77[a]	77.75[a]	70.50[b]	66.70[c]	60.15[c]	0.01
Ash	69.30[a]	.3683[a]	60.34[b]	55.80[c]	52.25[d]	0.02
NFE	79.60[a]	79.47[a]	75.02[b]	70.63[c]	70.80[d]	0.11

[abcd]Means within the same row with different superscripts differ significantly (P<0.05 SEM = standard error of means NFE=Nitrogen Free Extract

Conclusion and Applications

Based on the results obtained in this study, it can be concluded that

1. TMSM has significant effect on the growth performance of broiler chickens.
2. TMSM based diets significantly influence the digestibility of dry matter, crude protein, crude fibre, ether exract, ash and nitrogen free extract which were better for birds on 10% TMSM diet.
3. TMSM can be included into diet of broiler finisher up to 10% thus having significant effect on performance. The general performance of TMSM based diets was comparable to the control. The replacement levels were also found to yield higher economic value as their inclusion reduced cost/kg of feed.

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