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EFFECTS OF TOASTED MUCUNA SEED MEAL (TMSM) ON GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS OF BROILER FINISHERS.

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ABSTRACT

Conventional poultry feed ingredients such as soybean and groundnut which serve as sources of protein are costly and in deep demand for by man. Therefore there is the need to constantly be in search for alternative feed ingredients (AFIs) that are cheap and in less competition with man. However there is limitation in reliance on AFIs to sustain animal production because of low nutritive values. The study aimed at improving the nutritive value of AFIs such as Mucuna pruriens seeds for sustainable poultry production. Three hundred four – week old broiler chicks were allocated to five experimental diets in a completely randomized design. Toasted Mucuna seed meal was prepared and fed in graded levels of7.5,15.0,22.5, and 30.0 % representing T2, T3, T4 and T5 respectively to replace groundnut cake alongside, control (T1).Dietary effects on final weight, weight gain, feed intake, feed to gain ratio, feed cost per kilogram gain and carcass parameters were evaluated. The results obtained showed that the final weight of T2 (2710g) and T3 (2715g), the weight gain of T2 (1705g) and T3 (1710g), feed intake of T2 (3350g) and T3 (3349g) and feed to gain ratio of T2 (1.96) and T3 (1.96) were statistically ($P>0.05$) similar relative to T1 and significantly ($P<0.05$) higher than those of birds on T4 and T5. Feed cost per kilogram gain were lower for all TMSM diets (from ₦192 in T1 to ₦143 in T5). Carcass weight of T2 (2040.00g) and T3 (2040.33g), dressing percentage of T2(74.28%) and T3 (74.41%) were similar in relative to T1 and higher than those of T4 and T5. It was concluded that inclusion of TMSM in the diets of broiler chicks up to 15.0% has beneficial effects for sustainable poultry production

Keywords: Toaste**,** Performance, graded levels, Mucuna, Broiler finisher

Introduction

Nigeria is a populous and sundry country with high prevalence of nutritional deficiency varying widely across its boarders owing to high cost and inadequate supply of animal protein (Adekunle *et al*., 2017). As at 2019, Nigeria's per capita daily protein intake (45.5g) was lower than the Food and Agriculture Organization (FAO) recommended minimum per capita daily protein intake (53.8g) indicating that the country is faced with protein deficiency (Akerele *et al*., 2017). Protein-energy malnutrition is still prevalent in Nigeria as a result of the decline in protein consumption owing to scarcity and unaffordable price of animal protein food source ((De Vries-ten Have *et al*., 2020).

Poultry industry is a viable industry that could ameliorate the situation of nutritional deficiency by providing animal protein such as eggs and chicken . However, as viable as this industry is its survival is threatened by high cost of feed, as a result of the high cost

of conventional ingredients such as maize, soybean and groundnuts. Feed cost was estimated to be about 67-75% of the total cost of production (Ogundipe *et al*.,2 003; Akure *et. al*.,2020).This high cost of feed has been attributed to the over-dependence on the expensive conventional feed ingredients such as soybean and groundnut which are mainly used in poultry feed formulation as major sources of protein. This high cost of feed necessitates research into Alternative Feed Ingredients (AFIs) that are readily available, cheap and nutritionally safe for the consumption of poultry. This is necessary to reduce the high cost of feed and subsequently reduce the high cost of animal products thereby making it affordable to many Nigerians hence improving their nutritional efficiency.

Utilization of Mucuna (*Mucuna pruriens*)seeds which has crude protein of about 33.4% can serve as one of the AFIs in formulating poultry diets and can lower feed cost because they are cheaper and are not consumed as food by humans. The seeds however, contain anti-nutritional factors such as trypsin inhibitor, tannins, phytic acid (Akure, 2013, Akure *et al*., 2020),which need to be detoxified before they are fed to poultry (Akinmutimi and Okwu, 2006). Toasting is one of the processing methods that can be used to treat mucuna seeds to eliminate the anti-nutritional factors to a significant level, that can be used in poultry diets. Siddhuraju and Becker (2005) found dry heat treatment to be the most effective in reducing L-DOPA in Mucuna seeds and attributed the reduction to racemization under roasting. Bressani, (2002) showed that roasting of Mucuna seeds reduced trypsin inhibitors significantly (raw vs 30 mins roasting; 18.90 vs.1.58 TIU/mg). Akinmutimi *et. al*., (2009), Akinmutimi, (2004) and Akimutimi and Okwu, (2006) in their work reported 10.00, 36.36, 45,73, and 100% reduction in L-DOPA, tannin HCN and trypsin inhibitor of *Mucuna solanei* when toasted. This research therefore, aims at evaluating the effect of feeding graded dietary levels (0, 7.5, 15.0, 22.5 and 30%), of toasted Mucuna seeds meal on the growth performance and carcass characteristics of broiler finishers and to know the value of the toasted mucuna *(Mucuna pruriens*) seeds meal that could be added to the feed of broiler finisher chickens as an alternative source of conventional protein for a sustainable poultry production.

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. Kano state is located in the North Western Nigeria. Kano State borders Katsina State to the North-West and Jigawa State to the North-East. Kano State features savanna vegetation with a semi-arid climate. It occupies an area approximately 20,131km^2.

The area lies between latitude 11^{o}55’49”N and 11^{o}59’43”N and longitude 8^{o}31’18”E and 8^{o}36’19”E at an altitude of 460m above sea level. It witnesses an average precipitation of about 690mm per year, the bulk of which falls from June to September. The state is typically hot throughout the year, though noticeably cool from December to February. The annual temperature ranges between19.06^{o}C to 33.19^{o}C and humidity of 52.81 %. (KNARDA , 2021).

Experimental diets

Five experimental diets of Mucuna seed meal were prepared. as T1, T2, T3, T4 and T5 at 0, 7.5, 15.0, 22.5 and 30% toasted MSM respectively. The feed composition for the finisher chicks is shown in Table 1. Sample of Mucuna pruriens bean were toasted in an open pan containing about 200g of sand. The pan was placed on fire with sand inside it and heated for 10minutes. Raw Mucuna seeds were poured into 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

Table: 1 Gross composition of experimental diet for Broiler finishers containing toasted Mucuna seed meal (TMSM)

Ingredients (%)	Levels of TMSM, %				
	0(T1)	7.5(T2)	15.0(T3)	22.5(T4)	30.0(T5)
Maize	55.05	51.80	47.95	43.00	39.25
Groundnut cake	25.00	20.75	17.10	14.55	10.80
Mucuna seed meal	0.00	7.50	15.00	22.50	30.00
Soybean meal	8.00	8.00	8.00	8.00	8.00
Maize offal	5.00	5.00	5.00	5.00	5.00
Fish meal	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	0.69

*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.

Experimental birds

A total of three hundred (300), four- week old Marshall breed broiler chicks (mixed sexes) were used for this study. The birds were randomly assigned to pens in a completely randomized design (CRD). There were five treatments and three replications of the five treatments each with 20 birds per pen. The management of the birds was carried out according to the standard procedures for brooding, vaccination and medication (NRC, 1994). Birds were supplied with experimental diets and fresh water *ad libitum* throughout the trial period.

Performance study

The 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.

Carcass assessment

At the end of the feeding trial, one bird per pen (3 per treatment) was randomly selected and slaughtered for carcass evaluation. Hot carcass weight was taken and expressed as dressing percentage. Also, the weights of cut parts such as thigh, drumstick, breast, wing and back were taken; the weights of liver, gizzard and heart were also taken and expressed as percentages of carcass weight.

Statistical Analysis

Data obtained from the performance and digestibility evaluation were subjected to analysis of variance (ANOVA) using procedure of SAS (2002), significant levels of differences among treatment means were determined using the Duncan's multiple range test.

Results and Discussion

The performance of broiler finishers fed toasted Mucuna seed meal at various graded levels of 0.0, 7.5, 15.0, 22.5 and 30.0%. is revealed in table 2. There were significant differences between treatment means for final weight, weight gain, feed intake and feed to gain ratio. The final weight, weight gain, feed intake and feed to gain ratio, of birds fed 0.0, 7.5, and 15.0% toasted Mucuna seed meal (TMSM) were similar, higher and better than those on other treatments. It was also observed that the final body weight (g/bird), weight gain (g/bird) and feed intake (g/bird) decreased significantly as dietary levels of inclusion of TMSM further increased from 22.5 to 30.0%. The feed to gain ratio also increased as the levels of TMSM increased.

The similar high feed intake, weight gain and final weight obtained for the birds fed 7.5, 15.0 and 22.5% TMSM and those on the control diet could be an indication that chicks were able to efficiently utilize TMSM at 7.5 and 15.0% better than other levels. Thus result of better feed to gain ratio observed for birds fed 7.5 and 15.0% TMSM could also be due to the fact that there were sufficient digestible nutrients that were better utilized at

this level of lower anti-nutritional factors. The reduced weight gain observed as the dietary level of inclusion increased from 22.5 to 30.0% TMSM also could be attributed to the reduced feed intake and poor efficiency of feed utilization which limited the availability of digestible nutrients. These findings are in consonance with the report of Dada et al. (2000) who observed that weight gain in broilers was directly related to feed intake, quality of feed as well as efficiency of feed utilization.

There was significant decrease among treatment means for feed cost per bird and per kilogram gain, which decreased as the dietary levels of TMSM increased. The feed cost per bird and per kilogram gain were significantly 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 cherished as human food. It could also be because of the reduction of groundnut cake and soybean in the TMSM diets. Bawa (2003), also reported a significant reduction in feed cost and total cost per animal when unconventional legume (Lablab purpurens) were utilized in pig diets. The feed cost/kg gain were significantly better for all the TMSM compared to the control diet. This shows that lower cost of feed can be achieved when an unconventional legume seeds like *Mucuna pruriens* is used in feed formulation.

Table 2: Effects of feeding diets containing toasted Mucuna seed meal on performance of Broiler finishers (5-8weeks)

Measurements	0% (T1)	7.5% (T2)	Levels of TMSM 15% (T3)	22.5% (T4)	30% (T3)	SEM
Initial weight (g/bird)	1005	1005	1005	1005	1005	0.00
Final weight (g/bird)	2728^{a}	2710^{a}	2715^{a}	2574^{b}	2430^{c}	8.01
Weight gain (g/bird)	1723^{a}	1705^{a}	1710^{a}	1569^{b}	1300^{c}	15.16
Feed intake (g/bird)	3370^{a}	3350^{a}	3349^{a}	3200^{b}	3100^{b}	50.28
Feed to Gain Ratio	1.96^{a}	1.96^{a}	1.96^{a}	2.03^{b}	2.31^{c}	0.02
Feed cost/kg weight gain (₦)	192^{e}	170^{d}	154^{c}	153^{b}	145^{a}	1.04
Feed cost/bird (₦)	490^{d}	477^{c}	475^{bc}	472^{b}	466^{a}	0.47

^{abcd} Means within the same row with different superscripts differ significantly ($P<0.05$) SEM = standard error of mean

Carcass characteristics of broiler finisher birds fed TMSM based diets is shown in table 3. There were significant differences between the treatment means for all measurements except relative weights of neck, heart and gizzard. The results of the control, 7.5 and 15.0% TMSM diets were similar and gave the best result for the carcass weight and dressing percentage when compared with other treatments. Birds on the control, 7.5 and 15.0% TMSM diets also gave the best result for the cut parts such as thigh, drumstick, breast, wing, and back weights. The weights of liver were similar for birds fed the control, 7.5 15.0 and 22.5 TMSM diets, this result could infer that toasting Mucuna seeds reduced anti-nutritional factors thereby was not deleterious to the birds. The enlargement of liver for the 30% TMSM inclusion in this study could be due to increased metabolic

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activities of the liver in trying to detoxify the little residual anti-nutritional factors at this inclusion level since liver serves as the detoxification centre.

The results of the carcass weight, dressing percentage and cut parts such as thigh, drumstick breast, wing, and back weights of the control 7.5 and 15.0% TMSM diets being higher when compared with other treatments could be an indication that there was an efficient utilization of feed by the birds on these diets, due to lower concentration of anti-nutritional factors. This led to better carcass development and meat yield on these three diets. The reduction in carcass weight from 22.5 to 30% levels of toasted Mucuna seed meal inclusion could be due to low feed intake and utilization of feed. Fetuga, (1975) indicated that carcass quality were closely related to the intake level of nutrients especially protein and energy

Table 3. Carcass characteristics of broiler finisher chickens fed toasted Mucuna seed meal based diets

Parameters	0.0(T1)	7.5(T2)	Levels of 15.0(T3)	TMSM,% 22.5(T4)	30.0(T5)	SEM
Live wt. (g)	2703.67^{a}	2700.60^{a}	2772.33^{a}	2420.00^{b}	2400.67^{b}	1.21
Bled wt.(g)	2590.00^{a}	2589.00^{a}	2586.67^{a}	2370.00^{b}	2300.00^{c}	0.79
Plucked wt.(g)	2503.33^{a}	2500^{a}	2372.00^{b}	2310.00^{c}	2183.00^{d}	0.63
Carcass wt (g)	2047.00^{a}	2040.00^{a}	2040.33^{a}	1783.67^{b}	1780.00^{c}	2.74
Dressing %	74.69^{a}	74.28^{a}	74.41^{a}	71.81^{b}	71.63^{c}	0.04
		Cut parts	Expressed as	%	Carcass	weight
Thigh	13.21^{a}	13.38^{a}	13.51^{a}	11.16^{b}	10.33^{c}	0.08
Drumstick	15.25^{a}	15.31^{a}	15.15^{a}	13.22^{b}	11.24^{c}	0.03
Breast	19.90^{a}	19.88^{a}	19.40^{a}	17.96^{b}	16.26^{c}	0.04
Back	17.42^{a}	17.82^{a}	17.40^{a}	16.67^{b}	15.68^{c}	0.05
Wing	8.50^{a}	8.40^{a}	8.26^{a}	7.86^{b}	6.83^{c}	0.32
Neck	5.00	5.01	5.00	5.00	5.00	0.03
		Organs	Expressed as	%	live	weight
Heart	0.46	0.46	0.47	0.47	0.47	0.05
Liver	1.66^{a}	1.66^{a}	1.69^{a}	1.70^{a}	1.90^{b}	0.03
Gizzard	1.89	1.89	1.89	1.90	1.90	0.06

Conclusion

The results obtained in this study indicated that inclusion of toasted Mucuna seed meal in the diet of finisher broilers is beneficial. Birds on 7.5 and 15.0% TMSM showed the same performance with birds on the control diet and were able to produce 1kg of meat at a reduced cost when compared to birds on the control diet. It is therefore recommended that TMSM can be included in broilers diet at 15% as a source of protein.

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