GROWTH PERFORMANCE AND NUTRIENT DIGESTIBILITY OF BROILER FINISHERS FED FERMENTED MUCUNA *PRURIENS* SEED MEAL

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ABSTRACT
This study was carried out to evaluate the effect of fermented Mucuna Seed Meal (FMSM) on the growth performance, nutrient digestibility and haematological parameters of broiler finisher chicks. In a four-week feeding trial, four hundred and fifty (450) 4-week old broiler chicks were randomly allocated to five experimental diets in a completely randomized design (CRD). Each treatment was replicated thrice having thirty (30) birds per pen. Fermented Mucuna seed meal was prepared and fed in graded levels of 0.0% (control diet), 5.0%, 10.0%, 15.0%, and 20.0%FMSM. Feed and water were given to the birds ad libitum. The parameters measured and include final weight, weight gain, feed intake, feed to gain ratio and feed cost per kilogram gain. Digestibility of dry matter, crude protein; crude fibre, ash, nitrogen free extract and ether extract were also determined. The data collected were subjected to analysis of variance (ANOVA).The results showed that dietary levels of FMSM had significant (P<0.05) effect on these parameters. The final weight, the weight gain and feed intake of the birds fed 0.0%, 5.0%% 10% and 15.0% FMSM were statistically (P>0.05) similar but significantly (P<0.05) higher than those of 20%FMSM. Cost of feed per bird and feed cost per kilogram weight gain were lower for all FMSM diets. Digestibility of nutrients was better for the birds fed the control, 5.0, 10.0 and 15.0%FMSM based diets. There were no significant differences (P>0.05) between the treatment means for packed cell volume (PCV), heamoglobin (Hb) and total protein (Tp).It was concluded that inclusion of FMSM in the diets of broiler finisher chicks up to15% has no deleterious effect on growth performance, haematological parameters and nutrient digestibility of the birds.

Keywords: *Broiler finisher, digestibility, haematology, Mucuna pruriens, Performance*

INTRODUCTION

One of the major constraints confronting developing countries including Nigeria is the furnishing of its ever increasing population with sufficient food. This is because the human population is increasing geometrically and this does not match the increase in food production which increases arithmetically. Nigeria is richly endowed with a variety of animal protein sources yet unable to provide these animal proteins in sufficient quantities to meet the requirements of its citizenry. FAO(1993) recommended a minimum requirement of 54g of animal protein/ person/day to be consistent with a balanced diet, unfortunately many Nigerians consume less than 10g/day. This is because in developing countries,

like Nigeria, there is a gross dependence on grains and oilseeds such as maize, groundnuts and soybean as the main source of energy and protein for poultry. The high demand by both man and animals for these energy and protein sources results in a constant increase in the price of grains, soybean and groundnut.

This prevailing condition has led to the continuous search for the use of under-utilized tropical legume seeds as feed ingredients in poultry production. The ecological and climatic conditions prevailing in the tropical regions allow the growth of a large variety of species with nutritional potential that is adequate for poultry. Legumes are a good sources of crude protein, (Akure, 2013, Mugendi *et al*., 2010). *Mucuna pruriens also* called Velvet bean, is originally from tropical Asia (Huisden *et al*., 2014) and has high crude protein content, carbohydrates and acceptable levels of fibre for animal feeding (Akure, 2013*;* Safwat *et al.*, 2015). This legume can serve as an alternative in poultry feeding. However, a variety of anti-nutritional factors such as phytates, oxalates, trypsin inhibitors, L-3, 4-dihydroxyphenylalanine (L-DOPA) tannins, saponnins, hydrogen cyanide and lectinshave been identified in *Mucuna pruriens*seeds (Iyayi *et al.,* 2008, Akure, 2013), which reduce digestibilityof the diet (Akure, 2013)., so there is a need to look for processing methods that could reduce these anti-nutritional factors to a level where they will be safe for poultry consumption. The heat labile characteristic of some anti - nutritional factors reported for *Mucuna pruriens*, such ascyanogenic glycosides (Acamovic and Brooker 2005), trypsin inhibitors, tannins (Siddhuraju and Becker, 2001; Akure, 2013; Akure, 2020) and phenols (Preet and Punia 2000), allows their elimination with heat treatments (Del Carmen *et al.,* 1999, Iyayi *et al.,* 2008). Inclusion of 40% of *mucuna pruriens* in the starter phase and 60% in finishing phase have been reported as an adequate percentage for poultry diets (Vadivel *et al.,* 2011). In the same way, the inclusion of boiled *Mucuna pruriens* is viable up to 60% resulting in an improvement in productive performance (Tuleun *et al.,* 2009), however, raw *Mucuna pruriens* is toxic to birds (Tuleun and Igba 2008). Although L-Dopa in *M. pruriens* is not heat labile, and solubilization is one way to eliminate it. (Josephine and and Janardhanan 1992). However, there is a need to explore other means of eliminating some of the secondary metabolites that are not heat labile from the seed to allow its utilization in broiler diets without compromising their productive performance, Therefore, this research aims at evaluating the effect of feeding fermented *Mucuna* seed meals on the growth performance, haematological characteristics and nutrient digestibility 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°55'N and longitude 8°36'E at an altitude of 460m above sea level with an average annual rainfall of 600-1000mm, mean temperatures of 21.21°C and humidity of 52.81%. (KNARDA, 2011).

Preparation of experimental Diets

Five experimental diets were formulated. The Mucuna seeds were fermented for 72 hours. The inclusion levels of processed Mucuna seed meal were as follows T1 for control (0% FMSM), T2 (5.0% FMSM), T3 (10.0% FMSM), T4 (15.0% FMSM) and T5 (20% FMSM).The feed compositions of the broiler finisher diets are shown in Table 1.

Management of experimental birds

A total of four hundred and fifty (450) 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 21 birds per pen which constituted sixty three birds per treatment. The routine management such as maintenance of the poultry house hygiene was carried out. 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 feeding trial.

Growth performance

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, one bird per pen (3 per treatment that is a total of 15 per study) were selected and housed individually, in cages for faecal collection. The birds were allowed to acclimatize for seven days in the cages and also fed common diets for the seven days. After the seven days, the birds were fasted of feed for twenty four hours during which is expected that feaces from previous feeding would be voided out by the bird, 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^{o}C for seventy two (72) hours

Table 1: Compositions of broiler finisher diets containing fermented *Mucuna* seed (FMSM)

Ingredients	T1 0%	T2 5%	T3 10%	T4 15%	T5 20%
Maize	55.05	61.85	60.05	57.00	53.25
Groundnut cake	25.00	13.20	10.00	7.55	6.80
Mucuna	0.00	5.00	10.00	15.50	20.0
Soya bean meal	8.00	8.00	8.00	8.00	8.00
Maize offal	5.00	5.00	5.00	5.00	5.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Fish meal	2.00	2.00	2.00	2.00	2.00
Lime stone	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 premix	0.25	0.25	0.25	0.25	0.25
Total	**100**	**100**	**100**	**100**	**100**
Calculated Analysis					
ME (Kcals/kg)	3030	3010	3005	3002	3000
Crude Protein (%)	20.00	20.00	20.00	20.00	20.00
Crude fibre (%)	3.35	4.78	6.46	7.80	7.95
Ether Extract (%)	7.80	7.92	7.45	7.00	6.95
Ash (%)	6.40	6.45	6.40	6.42	6.15
Calcium (%)	1.27	1.28	1.27	1.28	1.28
Av.Phosphorus (%)	0.68	0.69	0.70	0.74	0.74
Lysine	1.10	1.12	1.14	1.12	1.12
Methionine.	0.77	0.69	0.61	0.67	0.68
Methio. + Cyst. (%)	0.85	0.77	0.80	0.78	0.76
Cost/kg diet (N)	72.15	70.22	69.45	65.75	63.50

**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 MSM; Mucuna Seed Meal, GNC; Groundnut Cake, SBM; Soya bean meal cake; i.u; international unit; M.E.; Metabolisable Energy. FMSM; Fermented Mucuna Seed Meal.*

and subjected to proximate analysis(AOAC, 1990).Values obtained were then used to calculate the apparent nutrient digestibility

Haematological study

At the end of the experiment, 2ml of blood samples, obtained through the wing vein was taken from one bird per pen (3 birds per treatment) into a sterile, universal bottles containing Ethylene diamine tetra acetic acid (EDTA), an anticoagulant. The blood samples were analyzed and the heamatological parameters measured were packed cell volume (PCV), heamoglobin (Hb) and total protein (Tp).

Statistical Analysis

All data obtained from the feeding trial were subjected to analysis of variance (ANOVA) using procedure of SAS (2002), and significant differences among treatment means were determined using the Duncan's multiple range test.

Results and discussion

Table 2 shows the performance of broiler finishers fed diets containing *Mucuna* seed meal. The final weight, weight gain, feed intake and feed to gain ratio, of birds fed 0%, 5.0% 10% and 15.0% fermented *Mucuna* seed meal (FMSM) were similar, but higher and better than those on 20% ,This could be an indication that chicks were able to efficiently utilize FMSM at 5%, 10.0% and 15% better than 20% FMSM. This result of better feed to gain ratio observed for birds fed 5%, 10.0% and 15.0% FMSM could also be due to the fact that there were sufficient digestible nutrients that were better utilized at this level. The reduced feed intake at 20% level of inclusion from this study agrees with the findings of Akure *et al*, 2020 who reported reduced feed intake in fermented *Mucuna* seed meal as dietary levels of inclusion of cooked *Mucuna* seed meal increased in the diets of broiler chickens. This could be attributed to the effect of residual anti-nutritional factors which became pronounced as the dietary levels of FMSM increased to 20%.The reduced weight gain observed at 20% FMSM 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 broiler chickens 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 FMSM increased. The feed cost per bird and per kilogram gain were significantly ($P<0.05$) better for all the FMSM diets compared to the control diet. This was because *Mucuna* seeds were cheaper and readily available without much competition with humans for food.

Table 2: Response of broiler finisher fed diets containing fermented *Mucuna* seed meal finisher phase

Parameters	Treatments					SEM	LOS
	T_1 0	T_2 5%	T_3 10%	T_4 15%	T_5 20%		
Initial weight (g)	860.50	860.50	860.50	860.50	860.50	0.00	NS
Final weight (g)	2721.67^a	2730.38^a	2725.83^a	2720.87^a	2461.22^b	0.68	*
Weight gain (g)	1861.17^a	1869.50^a	1865.37^a	1860.37^a	1600.72^b	0.65	*
Feed intake (g/b)	3615.00^a	3610.23^a	3600.50^a	3600.00^a	3300.00^b	0.06	*
Feed/Gain ratio	1.94^a	1.93^a	1.93^a	1.93^a	2.06^b	0.01	*
Feed cost/kg gain	143.22^a	141.23^b	140.76^c	140.71^c	139.10^d	0.02	*
Feed cost/bird	266.12^a	251.51^b	225.90^c	205.5^d	180.90^e	0.00	*
Mortality	2.24^b	0.00^a	11.09^c	2.24^b	12.30^d	0.00	*

^{abc}Means within the same row with different superscripts differ significantly ($P<0.05$)
*SEM = standard error of means *= significant difference NS =Not significant*

Table 3 and Table 4 show the results of the analyzed proximate composition of fermented *Mucuna* seed meal diets and the nutrient digestibility by broilers fed diets containing graded levels of FMSM, 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 highest digestibility of CP, CF, EE, Ash and NFE were observed in birds fed 5%, 10.0% and 15% FMSM diets which were similar to those of birds fed the control diet. This could be due to the fact that the birds better digested, absorbed and utilized the diets containing 5%, 10.0% and 15% FMSM.

Dietary nutrient intakes in the diets containing 5%, 10.0% and 15% FMSM were higher than those of birds fed 20.0% of FMSM. The significantly higher weight gain of the birds fed 0%, 5%, 10% and 15% FMSM diets compared to 20% level might have resulted from high nutrient intake and efficient nutrient digestion, absorption and utilization of the diets. The presence of highly digestible carbohydrate may be responsible for the high nutrient intake which resulted in high NFE digestibility in FMSM diets at 0%, 5%, 10% and 15% FMSM.

The significant (P<0.05) decrease in nutrient digestion at 20% FMSM could be attributed to low digestible carbohydrate and high residual effect of anti-nutritional factors at high levels of FMSM, hence the low feed intake recorded. The residual anti-nutritional factors in the *Mucuna* seed meal diets might have contributed to the decreased nutrient digestibility at the 20% levels. Akure (2013) reported that a high residual anti-nutritional factor in MSM has adverse effects on digestion absorption and utilization of nutrients. The residual effect of residual tannin and hydrocyanic couldreduce digestive efficiency, and cause serious impairment in the absorption of nutrients across the intestinal wall, since tannins are known to form strong complex with dietary

Table 3: Proximate composition of Broiler finisher diets containing fermented *Mucuna* seeds meal

Components (%)	T1 0%	T2 5%	T3 10%	T4 15%	T5 20%
Dry matter	96.20	96.00	96.25	96.00	95.25
Crude Protein	19.75	19.50	19.00	18.40	18.00
Crude fibre	3.85	4.98	5.55	5.65	6.70.
Ether Extract	6.30	6.52	6.70	6.75	6.85
Ash	6.90	6.65	6.82	6.50	6.85
NFE	50.68	48.95	48.56	48.20	48.50

Table 4: Effect of fermented Mucuna seed meal (FMSM) on nutrients digestibility of broiler finisher

	Treatments						
Parameters	**T1 0%**	**T2 5%**	**T3 10%**	**T4 15%**	**T5 20%**	**SEM**	**LOS**
Crude potein	87.74[a]	87.07[a]	87.53[a]	87.48[a]	84.01[b]	0.05	*
Crude fibre	51.71[a]	51.45[a]	51.10[a]	51.68[a]	43.74[b]	0.04	*
Ether extract	90.13[a]	90.13[a]	90.59[a]	90.85[a]	85.75[b]	0.03	*
Ash	60.99[a]	60.85[a]	60.06 [a]	60.82[a]	54.16[b]	0.04	*
NFE	88.67[a]	88.07[a]	88.98[a]	88.74[a]	77.98[b]	0.06	*

abc = Means within the same row with different superscripts differ significantly (P<0.05)
*SEM = standard error of means *= significant difference, NFE – Nitrogen Free Extract*

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. It is likely therefore, that the significantly lower weight gains of the birds fed the 20% FMSM diets relative to those on the 0%, 5%, 10% and 15% FMSM diets might have resulted from low nutrient intake and poor nutrient digestion and absorption of 20% MSM diet. This observation agrees with the work of Ani (2009), who reported depression in nutrient digestibility with increasing dietary castor bean meal (CBM) levels. This, the author, attributed it to the adverse effect of residual recin on nutrient absorption and utilization. Low feed intake which resulted in, low nutrient intake could subsequently result in low digestibility because of low nutrients.

The decrease in crude fibre digestibility by the broiler chickens as the level of FMSM increased in this study agrees with the findings of Adegbola and Okonkwo (2002), Agunbiade *et al.* (2002) and Ani (2009) who 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 FMSM diets could be due to the residual tannin content of the *Mucuna* seed meal, because tannins also form strong complex with minerals especially iron and prevents its absorption. Tannins have been reported to be important factor responsible for depressed feed intake and low absorption of minerals from food commonly consumed in India (Navasiringa and Prabhavathi, 1987). Moser *et al*. (1982) and Yaakugh *et al.* (1988) also reported a depressed digestibility of mineral matter as the level of fibre increased in the diets of pigs.

Table 5 shows the result of the effect of FMSM in broiler diets on some haematological parameters of broiler finisher chickens. There were no significant differences ($P>0.05$) between the treatment means for packed cell volume (PCV), haemoglobin (Hb) and total protein (Tp).The non-significant ($P>0.05$) difference shown in the PCV, Hb and Tp values indicate that any of the diets was good enough to supply sufficient nutrients for birds, and safe for human consumption.

CONCLUSION

FMSM improved performance of broiler finisher chickens. However, performance and digestibility of dry matter, crude protein, crude fibre, ether extract, ash, and nitrogen free extract were better for birds on 0% to 15% FMSM diet. Therefore it is concluded that inclusion of FMSM in the diets of broiler finisher chickens up to 15% had no deleterious effect on growth performance, haematological characteristics and nutrient digestibility of the birds.

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Table 5: Effects of fermented *Mucuna* seed meal-based diets on some blood parameters of broiler finishers

	Levels of FMSM, %					
Parameters	0.0	10.0	20.0	30.0	40.0	SEM
PCV (%)	30.55	30.50	30.52	30.53	30.50	0.07
Hb (g/d1)	10.63	10.60	10.64	10.62	10.63	0.04
TP (g/d1)	7.40	7.42	7.44	7.39	7.38	0.03

PCV= packed cell volume Hb= haemoglobinTp= Total protein SEM = standard error of means

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