Growth performance and nutrient digestibility of broiler finishers fed processed *Mucuna pruriens* seed meal

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Abstract

This study was carried out to evaluate the effect of 45 minutes Boiled *Mucuna* Seed Meal (BMSM) on the growth performance and nutrient digestibility of broiler finisher chicks. In a four-week feeding trial, three hundred and fifteen (315), 4-week old broiler chicks were randomly allocated to five experimental treatment diets in a completely randomized design (CRD). Each treatment was replicated thrice having twenty-one (21) birds per pen. Boiled *Mucuna* seed meal was prepared and fed in graded levels of 0.0% (control diet), 10.0%, 20.0%, 30.0%, and 40.0%BMSM. Feed and water were given to the birds *ad libitum*. The parameters measured and calculated 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 inclusion of BMSM had significant ($P < 0.05$) effect on these parameters. The final weight, the weight gain and feed intake of the birds fed 0.0%, 10.0% and 20.0%BMSM were statistically ($P > 0.05$) similar and significantly ($P < 0.05$) higher than those of other treatments. Cost of feed per birds and feed cost per kilogram gain were lower for all BMSB diets. Digestibility of nutrients was better for the birds fed the control, 10.0 and 20.0%BMSM based diets. It was concluded that inclusion of BMSM in the diets of broiler finisher chicks up to 20% has no deleterious effect on growth performance and nutrient digestibility of the birds.

Keywords: Performance, *Mucuna pruriens*, broiler finisher

La Performance de croissance et digestibilité des éléments nutritifs des finisseurs de poulet à griller nourris aux farines de graines *Mucunapruriens* transformées

Résumé

Cette étude a été réalisée pour évaluer l'effet de 45 minutes de farine de graines de *Mucuna* (le 'BMSM') bouillie sur la performance de croissance et la digestibilité des éléments nutritifs des poussins finisseurs de poulet à griller. Dans un teste d'alimentation de quatre semaines, trois cent quinze (315), poussins de poulet de griller de 4 semaines ont été aléatoirement attribués à cinq régimes expérimentaux de traitement dans une conception complètement randomisée (le 'CRD'). Chaque traitement a été reproduit trois fois avec vingt et un (21) oiseaux par enclos. Le repas bouilli de graine de *Mucuna* a été préparé et alimenté dans les niveaux classés de 0.0% (régime de contrôle), 10.0%, 20.0%, 30.0%, et 40.0%BMSM. L'alimentation et l'eau ont été données aux oiseaux *ad libitum*. Les paramètres mesurés et calculés comprennent le poids final, le gain de poids, la prise d'aliments pour animaux, le

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rapport alimentation/gain et le coût des aliments pour animaux par gain kilogramme. La digestibilité de la matière sèche, protéines brutes; des fibres brutes, des cendres, de l'extrait sans azote et de l'extrait d'éther ont également été déterminés. Les données recueillies ont fait l'objet d'une analyse de la variance (ANOVA). Les résultats ont montré que les niveaux diététiques d'inclusion de 'BMSM' ont eu un effet significatif ($P < 0.05$) sur ces paramètres. Le poids final, le gain de poids et la prise d'alimentation des oiseaux nourris 0.0%, 10.0% et 20.0%BMSM étaient statistiquement ($P > 0.05$) semblables et significativement ($P < 0.05$) plus élevés que ceux des autres traitements. Le coût de l'alimentation animale par oiseau et le coût de l'alimentation par kilogramme étaient inférieurs pour tous les régimes BMSB. La digestibilité des éléments nutritifs était meilleure pour les oiseaux alimentés le contrôle, 10.0 et 20.0%BMSM régimes à base. Il a été conclu que l'inclusion du BMSM dans l'alimentation des poussins finisseurs de poulet de grill jusqu'à 20 % n'a aucun effet délétère sur la performance de croissance et la digestibilité des oiseaux en matière d'éléments nutritifs.

Mots-clés: Performance, Mucunapuriens, finisseur de poulet à griller

Introduction

In Nigeria the livestock industry has not been able to supply adequately the much needed animal protein by the populace. Poultry production, especially the broiler chickens remains one of the dynamic ways of attaining sustainable and rapid production of high quality protein to meet the increasing demand of the Nigeria teeming populace (Apata and Ojo, 2002), due to short generation interval of broiler chickens (Akinmutimi, 2004). One of the main challenges in poultry enterprise is high cost of feed which is estimated to be about 70% of the total cost of production (Ogundipe *et al.*, 2003). This high cost has been attributed to the over-dependence on the expensive conventional feed stuffs such as soybean and groundnut cake which is mainly used in poultry feed formulation (Emenalon and Udedibie, 1998). A high demand for these feed ingredients has resulted in an increase in their prices and consequently, cost of poultry feeds and its products (Akinmutimi and Okwu, 2006). This necessitates research into non-conventional feedstuffs (NCF) that are readily available, cheap and nutritionally safe. One of these NCF is *Mucuna pruriens* seeds (Iyayi and Egharevba, 1998; Akure, 2013) which is a widely available

leguminous seed that thrive well where others fail due to excellent adaptability to extreme climatic conditions. It yields about three to four tonnes of seed per hectare. It is a potential source of protein because it is very high in crude protein. It has a crude protein of 29.89% (Akure, 2013). This research aims at evaluating the effect of feeding boiled *Mucuna* seed meals on the growth performance 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' and longitude 8°36' 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 boiled for 45 minutes. The inclusion levels of processed *Mucuna* seed meal were as follows **T1 for control (0% BMSM), T2 (10.0% BMSM), T3 (20.0% BMSM), T4 (30.0% BMSM) and T5 (40% BMSM)**. The feed

composition for the broiler finisher is shown in Table 1.

Management of experimental birds

A total of three hundred and fifteen (315) five-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 weight of the birds was 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 faeces 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°C for seventy two (72) hours and subjected to proximate analysis.

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

The faecal samples collected during the digestibility studies were subjected to proximate analysis (AOAC, 1990). Values obtained were then used to calculate the apparent nutrient digestibility

Statistical analysis

All data obtained from the feeding trial 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

Table 2 shows the performance of broiler finisher fed *Mucuna* seed meal. The final weight, weight gain, feed intake and feed to gain ratio, of birds fed 0%, 10.0% and 20.0% boiled *Mucuna* seed meal (BMSM) were similar, higher and better than those on other treatments, this could be an indication that chicks were able to efficiently utilize BMSM at 10.0% and 20% better than other levels. This result of better feed to gain ratio observed for birds fed 10.0 and 20.0% BMSM 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 30 and 40% levels of inclusion from this study agrees with the findings of Akinmutimi and Okwu (2006) who reported reduced feed intake in cooked *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 BMSM increased. The reduced weight gain

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observed as the dietary level of inclusion increased from 30% to 40% BMSM 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 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 BMSM increased. The feed cost per bird and per kilogram gain were significantly ($P<0.05$) better for all the BMSM diets compared to the control diet. This was because *Mucuna* seeds were cheaper and readily available without much competition with humans for food.

Table 1: Gross composition of broiler finisher diets containing boiled *Mucuna* seed meal (BMSM)

Ingredients (%)	Levels of BMSM(%)				
	0	10	20	30	40
Maize	55.05	51.55	46.95	40.00	32.25
Groundnut cake	25.00	18.50	13.10	10.05	7.80
<i>Mucuna</i> seed meal	0.00	10.00	20.00	30.00	40.00
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 (%)	3001	3000	3112	3020	3025
ME (Kcal/kg)					
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 (N)	71.15	68.22	67.45	63.75	60.50

*Biomix Premix supplied per kg of diet: Vit. A, 10000 I.U; Vit.D₃, 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. *Computed in the year 2011

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

	Levels of BMSM					
Parameter	0%	10.0%	20.0%	30.0%	40.0%	SEM
Initial weight (g/b)	1094.00	1095.00	1095.00	1095.00	1095.00	0.00
Final weight (g/bird)	2528.03 ^a	2500.00 ^a	2500.67 ^a	2154.73 ^b	2145.93 ^c	7.01
Weight gain (g/bird)	1434.03 ^a	1405.00 ^a	1405.67 ^a	1090.73 ^b	1050.93 ^c	12.44
Feed intake (g/bird)	3270.63 ^a	3280.91 ^a	3280.42 ^a	3166.88 ^b	3167.77 ^b	40.38
Feed to Gain Ratio	2.28 ^a	2.30 ^a	2.33 ^a	2.90 ^b	3.00 ^c	0.02
Feed cost/kg weight gain (₹)	162.57 ^c	150.22 ^d	144.58 ^c	143.41 ^b	135.23 ^a	1.04
Feed cost/bird (₹)	490.44 ^d	477.58 ^c	475.24 ^{bc}	472.48 ^b	466.32 ^a	0.47

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

Table 3 and Table 4 show the result of the analysed proximate composition of boiled *Mucuna* seed meal diets and the nutrient digestibility by broilers fed diets containing graded levels of BMSM 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 similar for birds fed control

and those fed 10.0% and 20% BMSM diets but decreased significantly ($P<0.05$) as the level of inclusion of boiled *Mucuna* seed meal increased from 30% to 40% levels. The highest digestibility of CP, CF, EE, Ash and NFE were observed in birds fed 10.0% and 20% BMSM 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 10.0% and 20% BMSM.

Table 3: Proximate composition of broiler finisher diets containing boiled *Mucuna* seeds meal (BMSM)

Parameter	0.0	Levels of BMSM(%) 10.0	20.0	30.0	40.0
Dry matter	96.00	95.60	94.65	92.20	92.00
Crude Protein	19.95	19.86	19.68	19.60	19.50
Crude fibre	7.70	7.00	7.23	7.63	7.70.
Ether Extract	8.86	7.10	7.40	7.35	7.75
Ash	6.90	6.75	6.55	6.20	6.10
Nitrogen free extract	53.00	52.95	52.88	52.20	51.00

Table 4: Effects of boiled *Mucuna* seed meal based diets on nutrients digestibility by broiler finishers (%)

Parameter	0.0	10.0	Levels of BMSM(%) 20.0	30.0	40.0	SEM
Dry matter	92.60 ^a	92.40 ^a	92.50 ^a	90.72 ^b	87.60 ^c	0.02
Crude protein retention	87.80 ^a	87.82 ^a	87.81 ^a	82.50 ^b	80.70 ^c	0.03
Crude fibre	62.00 ^a	62.80 ^a	62.20 ^a	52.30 ^b	49.30 ^c	0.01
Ether extract	85.75 ^a	85.72 ^a	85.30 ^a	79.72 ^b	71.10 ^c	0.03
Ash	72.10 ^a	72.15 ^a	72.24 ^a	55.60 ^b	50.50 ^c	0.04
NFE	91.60 ^a	91.57 ^a	91.00 ^a	85.60 ^b	80.82 ^c	0.22

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

Dietary nutrient intake in the diet containing 10.0% and 20% BMSM was higher than those of birds fed 30.0% and 40.0% of BMSM. Hence, the significantly higher weight gain of the birds fed 0%, 10% and 20.0% BMSM 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 BMSM diets at 0%, 10% and 20.0%BMSM. The significant ($P<0.05$) decrease in nutrient digestion as the dietary inclusion level of BMSM increased could be attributed to low digestible carbohydrate and high residual effect of anti-nutritional factors at high levels of BMSM hence low feed intake recorded. Akure (2013) reported that anti-nutritional factors in MSM has adverse effects on digestion and utilization of nutrients. The residual effect of residual

tannin and hydrocyanic could also reduce 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 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 BMSM increased in this study agreed 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 BMSM diets could be due to the residual tannin content of the *Mucuna* seed meal, because tannin also form strong complex with minerals especially iron and prevents its absorption. Tannin has been reported to be an important factor responsible for depressed feed intake and low absorption of minerals from food commonly consumed in India (Navasiringa and Prabhavathi, 1987).

Conclusion

BMSM inclusion in diets at 0% to 20% improved performance of broiler finishers. However, performance and digestibility of dry matter, crude protein, crude fibre, ether extract, ash, and nitrogen free extract were better for birds on 20% BMSM diet. It was concluded that inclusion of BMSM in the diets of broiler finisher chicks up to 20% had no deleterious effect on growth performance and nutrient digestibility of the birds.

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