Growth performance, carcass characteristics and economics of production of broiler chickens fed graded levels of *Mucuna sloanei* seed meal mixed with enzyme

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One hundred and twenty (120), 1 week old broiler chicken were randomly assigned to 4 treatment diets in a completely randomized experiment that lasted 49 days. The diets were made with soya bean based diet (D1) as control and treatment diets D2, D3, D4 containing graded levels (7.5%, 10%, 12.5%) of boiled *Mucuna sloanei* seed meal mix with enzyme (BME). Birds fed diet 2 (7.5% BME) had higher final body weight 2216.70g. The test diets gave lower total feed in-take value that was significantly ($P < 0.05$) lower than that of the control. D2 gave the lowest feed-to-gain ratio (1.72) that was significantly ($P < 0.05$) different from those of the control (2.09), D3 (2.08) and D4 (2.27). There was no significant difference ($P > 0.05$) among birds fed the treatment diets and those fed the control diet for dressed weight percentage and back cut percentage. D2 had cost/Kg weight gain and gross margin (N190.44 and N686.97 respectively) that were numerically higher than those of the control (N272.75 and N660.68) but statistically higher than those of, D3 (N241.45 and N505.29) and D4 (N274.45 and N387.71). The optimal level of inclusion of qualitative replacement of the soya bean meal with boiled *Mucuna* seed meal mixed with enzyme in this experiment was 7.5% which performed better than the control in all the parameters considered and is therefore recommended for replacement of soya bean meal in the diet of broiler chickens. Inclusion of *Mucuna sloanei* seed meal from 10 % and above will not yield good carcass that would be comparable to the control (soya bean based diet)

Keywords: Broiler chickens, *Mucuna sloanei* seed meal, enzyme

Introduction

The level of animal protein intake in most developing countries of the world including Nigeria is low due to high cost of conventional feed stuff such as soya bean meal, groundnut cake, etc because they are competed for by man and industry (Akinmutimi *et al.*, 2006). Feed cost has been constantly reported to be a hindrance to the progress of poultry production worldwide. The cost of feed in poultry is considered to be important because it is between 60-80% of the total cost of production (Ojewola and Olugbemi, 2011). The high cost of poultry feed has been traced to increased cost of conventional feed stuffs (Akinmutimi *et*

al., 2011). Due to high cost of poultry feed, Nigerian have experienced serious animal protein deficiency leading to malnutrition. This has necessitated the search for alternative feed stuffs and the use of different feed additives to supplement the conventional feed ingredients.

One of the underutilized legumes that come in mind is *Mucuna sloanei*. Its consumption by humans is localised and in many cases, it appears to be a last resort legume in circumstances of famine and scarcity (Ukachukwu and Obioha, 1997). The seeds are highly resistant to disease and pest and exhibit good nutritional qualities (Vadiwel and Janardhanan, 2000). It yields about 0.8-2 tonnes of seeds per hectare with crude

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protein of about 28% (Ijeh *et al.*, 2004). One of the major problems with legume utilization is the presence of anti-nutritional factors (Oke *et al.*, 1996). The anti-nutritional factors are known to cause negative effects such as less efficient feed conversion, poor growth, intermittent scouring, wasting and sometimes death of animals when consumed raw (Ologhobo, 1992). *Mucuna sloanei* seeds have been reported to contain anti-nutrients like tannins, phytins, L-Dopa, cyanogenic glycosides, etc (Ijeh *et al.*, 2004). Enzymes are added to feed stuffs to breakdown this anti-nutrient and release more nutrients for the use of animals. Report from Abbas *et al.* (1998) stated that enzyme supplementation to fibrous diet improved the growth rate, thereby increasing the dressing percentage. Bharathhasan *et al.* (2009) reported a marginal increase in dressing percentage and carcass yield in birds fed enzyme supplemented reduced energy and protein diet.

Materials and methods

One hundred and twenty (120), 1 week old broiler chicken were randomly assigned to 4 treatment diets in a completely randomized experiment that lasted 49 days at The Poultry Unit of The Teaching and Research Farm, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria. *Mucuna sloanei* seed (Ukpo) was purchased in Aba main market in Aba, Abia State, Nigeria. The following methods were used in processing of *Mucuna* seed.

Boiling in water for 30 minutes

The ratio of liquid to solute was 2:1 (i.e. 2 litre of water was used for 1kg of *Mucuna* seed). The seed was added into the water at boiling point and allowed to boil

for 30 minutes after which the heat was removed the water decanted and the seed dried and milled to pass through 2 millimeter sieve, bagged and stored for use in feed formulation for the broiler chicken

The diets were made of control D1 (soya bean based), and treatment diets, D2, D3, D4 containing graded levels (7.5%, 10%, 12.5%) boiled *Mucuna sloanei* seed meal mix with enzyme (BME)

The experiment was a completely randomized design (CRD). The feed and water were given *ad-libitum* throughout the period. The birds were given a measured quantity of feed every day and on the following day the left over were removed and measured to determine the quantity consumed by the birds. The birds were subjected to standard broiler management with necessary drugs and vaccines given as at when due. The experiment lasted 49 days. A total of five diets were formulated having crude protein range of 22.10-22.39% and energy level of 2933.60.5-3003.60 kcal/kg as shown in Table 1

Data collection

Growth performance

Feed intake and weight gain were determined on weekly bases. This was used to calculate the feed to gain ratio. Mortality if any was recorded daily. Data obtained were calculated as follows.

Feed intake/bird/day (g) = $\frac{\text{Quantity of feed given} - \text{Qty not consumed}}{\text{No of birds} \times 49 \text{ days}}$

Daily weight gain/bird (g) =

$\frac{\text{Final liveweight} - \text{initial weight}}{\text{Number of birds} \times 49 \text{ days}}$

Feed conversion ratio =

$\frac{\text{Quantity of feed consumed}}{\text{Weight gain}}$

% mortality = $\frac{\text{Number died}}{\text{Number stocked}} \times \frac{100}{1}$

Table 1: Composition of experimental diets containing graded levels of boiled *Mucunasloanei* seed meal mix with multi-enzyme and fed to broiler chickens

Ingredients	Levels of inclusion of <i>M. sloanei</i>			
	0%	7.50%	10%	12.50%
Maize	60.00	56.25	55.00	53.75
Soya bean meal	30.00	26.25	25.00	23.75
<i>Mucunasloanei</i>	-	7.50	10.00	12.50
Palm kernel meal	3.40	3.40	3.40	3.40
Fish meal	3.00	3.00	3.00	3.00
Bone meal	3.00	3.00	3.00	3.00
Vit premix	0.25	0.25	0.25	0.25
CommonSalt	0.25	0.25	0.25	0.25
Dl methionine	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00
Calculated composition				
Crude protein (%)	22.10	22.20	22.24	22.28
Crude fibre (%)	3.06	3.51	3.84	3.77
Calcium (%)	0.24	0.37	0.41	0.46
Phosphorus (%)	0.43	0.42	0.41	0.41
Methionine (%)	0.47	0.55	0.57	0.60
Lysine (%)	1.11	1.50	1.63	1.76
Metabolizable Energy(Kcal/Kg)	3003.60	2977.35	2968.60	2859.85

Each 2.5kg of premix contains Vitamin A (8,500,000 Iu), Vitamin D, (1,500,000 Iu), Vit E (10,000,000mg), Vitamin K3 (1,500,00mg), Vitamin B1 (1,600,000mg), Vitamin B2 (4,000,000mg), Niacin (20,000,000mg), Pentathenic Acid (5,000,00mg), Vit B6 (1,500,00mg), Vit B12 (10,000mg), Folic Acid (500,00mg), Biotin (750,00mg), Chlorine Chloride (175,000,00mg), Cobalt (200,00mg), Copper (3000,00mg), Iodine (1000,00mg), Zinc (30,000,00mg), Selenium (200,00mg), Managanese (40,000,00 Mg), Iron (20,000,00mg).

D1=control diet (noMucuna ,no enzyme); D2=7.5% Mucuna with enzyme; D3=10% Mucuna with enzyme; D4=12.5%Mucuna with enzyme. Maxi-grain multi enzyme supplemented at the rate of 100g/ton of feed to diets 2, 3 and 4 only

Carcass evaluation

At the end of the feeding experiment, two birds per replicate were randomly selected, starved for 24 hours, weighed and slaughtered by severing the jugular vein. They were thoroughly bled and scalded by dipping in warm water (50-55°C) before being defeathered. The defeathered birds were weighed, the head, shank, neck and visceral were separated from the carcass and then the dressed weight taken. Each dressed carcass was cut into parts as reported by Ojewola and Longe (1999) for the purpose of cut parts evaluation. All parts were weighed and expressed as percentage of dressed weight.

Result and discussion

The determined composition of experimental diets is presented in Table 2. The result revealed a protein content that ranged from 21.17- 22.71% and gross energy range of 4.08 – 4.10Kcal/g, respectively. These values fall within the requirement for effective broiler production in the tropics as recommended by Olomu (2011). It also meets the standard for straight line diet for broilers as reported by Akinmutimi (2011).

Table 3 shows the growth performance of 8 weeks old broiler chicken fed graded levels of boiled *Mucuna sloanei* seed meal mix with Maxi-grain (multi-enzyme).

Table 2: Determined composition of experimental diet for broiler chicken fed boiled *Mucuna* seed meal mix with enzyme

Parameters	0%	5%	10%	15%
Dry matter (%)	90.45	91.06	91.36	90.96
Crude protein (%)	21.74	22.17	22.44	22.71
Crude fat (%)	3.57	3.75	3.67	3.74
Crude fibre (%)	3.88	3.86	3.96	4.27
Ash (%)	6.81	6.41	6.04	6.46
Nitrogen free extract (%)	62.67	62.35	62.51	61.21
Gross energy (Kcal/g)	4.08	4.10	4.10	4.09

0%=DIET 1, 5%=DIET2, 10%=DIET3, 15%=DIET4

Significant ($P<0.05$) differences exist among all the parameters considered with the exception of initial body weight and mortality. For final body weight, D2 (7.5% Boiled *Mucuna* mix with enzyme = BME) had the highest value (2216.70g) among the treatment means which was not significantly different ($P>0.05$) from that of the control (2191.41g). This was followed by D3 (1863.30g) and D4 (1578.30g) which had the lowest value among the treatment means. Total weight gain and daily weight gain followed the same trend as that of final body weight with values ranging from 1492.70g (D4) to 2130.50g (D2) for total weight gain, and 30.47g (D4) to 43.45g (D2) for daily weight gain. D2 also had lower total feed intake value (3655.50g) that was significantly different ($P<0.05$) from that of the control (4448.80g) but was not significantly different ($P>0.05$) from the other two treatment means (D3=3697.00g; D4=3389.90g).

Daily feed intake followed the same trend (D2=74.60g; D1=90.79g; D3=75.45g; D4=69.19g). D2 had the least feed to gain ratio which was significantly ($P<0.05$) better than both that of the control, D3 and D4 these however were not significantly different ($P>0.05$) other two treatment means.

Boiled *Mucuna* seed meal mix with enzyme inclusion at 7.5% (D2) level

compared favourably with the control (zero percent *Mucuna*, no enzyme inclusion) for final body weight, total weight gain and daily weight gain but at 10% the performances of the birds dropped significantly ($P<0.05$) below that of the control for the same parameters. The result also revealed that the feed intake of the treatment diets were similar but significantly ($P<0.05$) lower than that of the control, thus D2 (7.5%) consumed less and deposited more flesh as is confirmed in the final body weight and total weight gain. This result is in line with earlier work by Adeyemi *et al.* (2013) who reported that the improvement in weight gain with enzyme supplementation in the presence of a relatively same feed intake across dietary treatment resulted in significant ($P<0.05$) reduction in the quantity of feed to gain a unit weight by broilers. The result also revealed that enzyme supplemented diets gave a good feed to gain ratio (FGR) that compared ($P>0.05$) favorably with the control at 10% and 12.5% *Mucuna* seed meal inclusion, and at 7.5% (ie diet 2) gave a better FGR that was significantly ($P<0.05$) lower than that of the control since the lower the FGR the better the quality of the diet. This confirmed the work of Adeyemi *et al.* (2013) that broilers fed enzyme supplemented diets gave a feed to gain ratio that were significantly ($P<0.05$) lower than those on the non enzyme supplemented diets. Earlier researchers

(Wang *et al.*, 1997; Huazhong *et al.*, 1999; Jackson *et al.*, 2004; Rahman *et al.*, 2005; Zou *et al.*, 2006; Onu *et al.*, 2011) also reported that exogenous enzyme greatly improved the feed conversion ratio of broiler chicks fed enzyme supplemented diet.

Considering the performance of birds on diet 2 (7.5% inclusion of boiled *Mucuna*

mixed with enzyme based diet) in final body weight, total weight gain, low feed intake, and improved feed to gain ratio, 7.5% (D2) is chosen as the best level that boiled *Mucuna* seedmeal mix with enzyme should be included in broiler ration. The result showed that there would be reduction in the growth performance parameters if same is included up to 10% and above in broiler ration.

Table 3: Growth performance of 8 weeks old broiler chicken fed graded levels of boiled *Mucuna sloanei* seed meal mix with maxi-grain enzyme (BME)

Parameters	Graded Levels Of BME (%)				SEM
	0	7.5	10	12.5	
Initial body weight (g)	86.47	86.13	87.47	85.60	0.8604
Final body weight(g)	2191.41 ^a	2216.70 ^a	1863.30 ^b	1578.30 ^c	79.8536
Total weight gain(g)	2104.90 ^a	2130.50 ^a	1775.90 ^b	1492.70 ^c	79.8411
Daily weight gain(g)	42.96 ^a	43.45 ^a	36.24 ^b	30.47 ^c	1.6270
Total feed intake(g)	4448.80 ^a	3655.50 ^b	3697.00 ^b	3389.90 ^b	1297.80
Daily feed intake(g)	90.79 ^a	74.60 ^b	75.45 ^b	69.19 ^b	2.6489
Feed to gain ratio	2.09 ^a	1.72 ^b	2.08 ^a	2.27 ^a	0.0695
Mortality (%)	9.67	9.33	9.67	9.67	0.1487

Means within the same row with different superscripts (a – c) are significantly (P< 0.05) different. SEM- Standard error of mean. 0=Diet1, 7.5= Diet2, 10= Diet3, 12.5= Diet4

The carcass characteristics of finisher broiler chicken fed graded levels of boiled

Mucuna sloanei seed meal based dietmixed with maxi-grain (multi-enzyme) is shown in Table 4.

Table 4: Carcass characteristics of finisher broiler chicken fed graded levels of boiled *Mucuna sloanei* seed meal based diet mix with maxi-grain enzyme(BME)

Parameters	Graded levels of BME in percentages				SEM
	0	7.5	10	12.5	
Live weight (g)	1926.30 ^a	1908.00 ^a	1682.00 ^b	1463.70 ^c	60.25
De-feathered weight(g)	1804.00 ^a	1763.70 ^a	1558.00 ^b	1250.30 ^c	57.88
Dressed weight (g)	1388.70 ^a	1342.70 ^a	1166.30 ^b	996.33 ^c	50.28
Percent dressed wt (%)	72.15 ^a	70.58 ^{ab}	69.36 ^{ab}	68.00 ^b	0.58
Breast (%)	31.72	21.43	32.34	31.26	0.35
Thigh (%)	17.97	17.68	17.52	17.51	0.17
Drum stick (%)	14.89	14.72	15.27	15.11	0.17
Back cut (%)	19.81 ^{ab}	20.58 ^a	19.44 ^{ab}	18.93 ^b	0.24
Wing (%)	12.94	12.92	13.00	13.49	0.12

Means within the same row with different superscripts (^{a-c}) are significantly (P< 0.05) different. SEM- Standard error of mean. 0=Diet1, 7.5= Diet2, 10= Diet3, 12.5= Diet4

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Significant ($P<0.05$) differences were observed in the live weight, de-feathered weight; percentage dressed weight and back cut. The result revealed that D2 compared favourably with D1 in the above mentioned parameters and was significantly ($P<0.05$) higher than D3 and D4 for same parameters except for percentage dressed weight where it (D2) was not significantly different ($P>0.05$) from D3 and D4. In case of the back cut, D2 was not significantly different ($P>0.05$) from D3 but have a significantly higher ($P<0.05$) value than D4. The improvement in carcass yield for enzyme supplemented diets has already been reported by earlier researchers. Lesson *et al.* (1996) reported increased dressing yield for the addition of enzyme due to higher fat deposition in the carcass.

Report from Abbas *et al.* (1998) stated that enzyme supplementation to fibrous diet improved the growth rate, thereby increasing the dressing percentage. Bharathhasan *et al.* (2009) reported a marginal increase in dressing percentage and carcass yield in birds fed enzyme supplemented reduced energy and protein diet.

Significant ($P<0.05$) differences were observed only in revenue and gross margin, while there was no significant ($P>0.05$) differences in cost of feed consumed and cost/kg weight gain.

For revenue, D2 was not significantly different ($P>0.05$) from D1 and had values

of N1074.10 and N1077.60 respectively) that were significantly ($P<0.05$) higher than those of D3 (N938.07) and D4 (N797.07). D4 had the lowest value that was significantly ($P<0.05$) different from other treatment diets. For gross margin, D2 had a value of N686.97 that was absolutely greater than that of D1 (N660.68) and significantly higher ($P<0.05$) than those of D3 (N505.29) and D4 (N387.71). D4 had the lowest gross margin value among the treatment diet. Looking at the absolute values of cost of feed consumed and cost per kg weight gain, it would be observed that D2 had the lowest absolute value (N405.20 for cost of feed consumed and N190.44 for cost per kilogram weight gain, respectively), while the control had N426.93 for cost of feed consumed and N272.75 for cost per kilogram weight gain.

The optimal level of inclusion of qualitative replacement of the soya bean meal with boiled *Mucuna seed meal* mixed with enzyme in this experiment was 7.5% which performed better than the control in all the parameters considered and is therefore recommended for replacement of soya bean meal in the diet of broiler chickens.

In view of the relative good performance of D2 for dressed weight, percentage dressed weight and back cut, D2 (7.5% level of inclusion of the boiled *Mucuna seed* + *Maxigrain* enzyme) has proven to be the best for broiler production in terms of quality carcass yield. Inclusion of *Mucuna sloanei* seed meal from 10 % and above will not yield good carcass that would be comparable to the control (soya bean based diet)

Table 5: Economics of production of broilers chicken fed diets containing graded levels of boiled *Mucuna sloanei* seed meal and mixed with enzyme

Graded Levels of BME (%)	0%	7.5%	10%	12.5%	SEM
Parameters					
Cost of feed consumed (₦)	426.93	405.20	428.12	409.32	6.71
Cost/ Kg feed (₦)	96.84 ^d	110.83 ^c	115.80 ^b	120.76 ^a	1.25
Cost /Kg wt gain (₦)	202.60 ^b	190.44 ^b	241.25 ^a	274.45 ^a	10.71
Revenue (₦)	1077.60 ^a	1074.10 ^a	938.07 ^b	797.07 ^c	38.02
Gross margin (₦)	660.68 ^a	686.97 ^a	505.29 ^b	387.71 ^c	37.10

Means within the same row with different superscripts (a – e) are significantly ($P<0.05$) different .SEM- Standard error of mean

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