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# Growth performance, carcass characteristics and economics of broiler chicken fed graded levels of raw Mucuna sloanei seed meal

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**Abstract**

*Growth performance, carcass characteristics and economics of broiler chicken fed graded levels of raw Mucuna sloanei seed meal were investigated. A total of 150, 1- day old broiler chickens were used. There were five treatments each replicated into three with 10 birds per replicate in a completely randomized design. Five treatment diets were formulated. Diet 1 served as control, while diets 2, 3, 4, and 5 had 5, 10, 15, and 20 %, respectively of raw mucuna seed meals (RMSM) added to them. The experiment lasted 49 days. The parameters considered were growth performance, carcass characteristics and economics of production. For growth performance, the result revealed that RMSM significantly (P<0.05) depressed growth as the levels of inclusion of RMSM increased from 0 to 20%. There were significant differences (p<0.05) in all the parameters considered under growth except for initial body weight and mortality. There was progressive loss in final body weight as the level of mucuna inclusion increased from 0% to 20%. Control recorded the highest live body weight of 3023.30g while, birds fed diet with 20% mucuna had the least body weight of 504.43g. Among the birds placed on the test diets, birds fed diet with 5% mucuna seed meal performed significantly (P<0.05) better (1840.00g) than other test diets. Birds fed diets with 10 and 15% mucuna had final body weight of 1180.00 and 726.67g, respectively. The progressive loss in weight was obvious early in the experiment and at 8 weeks of age the broiler fed 20% raw mucuna. Mucuna sloanei based diet weighed only 504.43g (16.68% of the control) as against 1840.00, (60.86% of the control) for that fed 5%.mucuna. Percentage dressed weight and percentage breast and thigh were significantly (P<0.05) higher for chicken fed control diet. 10% level of raw MSSM gave highest value for drumstick (14.91%) while control gave the least (13.00%). 5% raw MSSM (27. 71%) compared favourably with control (30.60%) for breast cut. Gross margin significantly decreased from N1459.80 for control diet to N 14.20 for D5 as the percentage inclusion of MSSM increases from 0 to 20%. In conclusion, birds fed raw Mucuna sloanei seed meal diet could not compare favourably with those fed soya bean based diets even at 5% level of inclusion. Processing is therefore recommended to enhance performance.*

**Keywords**: raw, *Mucuna sloanei*, graded levels, growth performance, carcass characteristics

## Introduction

Protein intake of an average Nigerian is very low partly resulting from the fact that conventional plant protein sources for poultry ration are very costly. This has led to competition between man and industry, and the livestock which is being placed at a disadvantage position because man must first feed and take care of himself before giving off the left over to his animals. *Mucuna sloanei* is a potential protein source that is cheap and widely available and of low human preference and of little or no industrial use and also can meet nutritional requirements of poultry with or without processing (Akinmutimi *et al*., 2011; Amaefule *et al*., 2013) Nutritional importance of *mucuna* seeds as a rich source of protein supplement in food and feed has been well documented (Siddhuraju

*et al.,* 2000; Siddhuraju and Becker 2001a; Bressani, 2002). Studies have been carried out on the seed characteristics and chemical composition of three morphotypes of *Mucuna urens* (L.) Medikus (horse eye bean, Nigeria) by Adeboye and Phillips (2006) and their results revealed that all three morphotypes are good source of crude protein (19.97-20.57%), carbohydrate (73.29-75.49%), fat (1.84-5.05%) and vitamins (11.24-17.10%). Ezeagu *et al*. (2003) studied the proximate composition of 12 *mucuna* accessions from Nigeria and found high protein (24.50-29.79%), fat (4.72-7.28%), carbohydrate (59.20-64.88%), crude fibre (3.65-4.43%), starch (39.22-41.17%) and gross energy (16.64-17.17 kJ/g). The dietary level of inclusion of raw *Mucuna sloanei* seed meal for broiler chicken that will enhance good performance is yet to be reported.

## Materials and methods

### Procurement and processing of *Mucuna sloanei* seed

*Mucuna sloanei* seed was purchased in Aba main market in Aba, Abia State, Nigeria. The seed was milled to pass through two millimeter sieve, bagged and stored for use in feed formulation for the broiler chicken

### *Experimental birds and management*

A total of 200 day old chicks were purchased from a reputable farm and brooded for one week **to** enable the birds stabilize. One hundred and fifty of same were transferred and randomly assigned to five treatment groups replicated into three with 30 birds per treatment and 10 birds per replicate in a deep litter pens spread with wood shavings. The experiment was a completely randomized design. 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 for 49 days (i.e. 7 weeks).

### *Experimental diets*

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*

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) =

$$\frac{\text{Qty of feed given} - \text{Qty not consumed}}{\text{No of birds} \times 49 \text{ days}}$$

Daily weight gain/bird (g) =

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

Feed conversion ratio =

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

% mortality =

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

## Result and discussion

The determined composition of experimental diet containing graded levels of raw Mucuna seed (DM basis) is shown in Table 2. The crude protein and energy content of the various diets met the standards for straight line diets for broiler production as recommended by Akinmutimi (2011).

The growth performance of 8 weeks old broiler chickens fed graded levels of raw *Mucuna sloanei* seed meal is shown in Table 3.

**Table 1: Percentage composition of experimental diets containing graded levels of raw *Mucuna sloanei* meal fed to broiler chickens**

| | Experimental Diets | | | |
|---|---|---|---|---|
| Ingredients (0%) | 5% | 10% | 15% | 20% |
| Maize 60.00 | 57.50 | 55.00 | 52.5 | 50.00 |
| Soya bean meal 30.00 | 27.5 | 25.00 | 22.5 | 20.00 |
| *Mucuna sloanei* - | 5.00 | 10.00 | 15.00 | 20.00 |
| Palm kernel meal 3.40 | 3.40 | 3.40 | 3.40 | 3.40 |
| Fish meal 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| Bone meal 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| Vit premix 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Common salt 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| DL methionine 0.10 | 0.10 | 0.10 | 0.10 | 0.10 |
| Total 100.00 | 100.00 | 100..00 | 100.00 | 100.00 |
| Calculated composition | | | | |
| Crude protein 22.10 | 22.18 | 22.24 | 22.18 | 22.39 |
| Crude fibre 3.06 | 3.25 | 3.38 | 3.51 | 3.64 |
| Calcium 0.24 | 0.32 | 0.39 | 0.47 | 0.54 |
| Phosphorus 0.43 | 0.50 | 0.60 | 0.65 | 0.71 |
| Lysine 1.11 | 1.37 | 1.65 | 1.89 | 2.15 |
| Methionine 0.47 | 0.53 | 0.57 | 0.62 | 0.66 |
| Metabolizable energy 3003.60 | 2996.10 | 2968.60 | 2935.10 | 2933.60 |

**Each 2.5kg of premix contains Vitamin A (8,500000 Iμ) Vitamin D (1,50000000 Iμ), Vit E (10,000000mg), Vitamin K3 (1,500,00mg), Vitamin B1 (1,600000mg), Vitamin B2 (4,00000mg), Niacin (20,00000mg), Pentathenic Acid (5,000,00mg), Vit B6 (1,50000mg), 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).**

**Table 2: Determined composition of experimental diet containing graded levels of raw Mucuna seed (DM basis)**

| | Experimental diet | | | |
|---|---|---|---|---|
| Parameters 0% | 5% | 10% | 15% | 20% |
| Dry Matter (%) 90.45 | 90.30 | 90.09 | 90.15 | 90.30 |
| Crude protein (%) 21.74 | 21.84 | 21.33 | 21.62 | 22.10 |
| Crude fat (%) 3.57 | 3.62 | 3.74 | 3.71 | 3.69 |
| Crude fibre (%) 3.88 | 3.94 | 4.35 | 4.34 | 4.20 |
| Ash (%) 6.81 | 6.85 | 7.17 | 7.23 | 7.34 |
| Nitrogen free extract (%) 64.00 | 63.75 | 53.41 | 63.10 | 62.67 |
| Energy (Kcal/g) 4.077 | 4..065 | 4.037 | 4.034 | 4.028 |

**0%=DIET 1, 5%=DIET2, 10%=DIET3, 15%=DIET4, 20%=DIET5**

**Table 3: Growth performance of broiler chicken fed diets containing graded levels of raw *Mucuna sloanei* seed meal**

| | Levels of raw *Mucuna* seed meal (%) | | | | | |
|---|---|---|---|---|---|---|
| Parameters | 0 | 5 | 10 | 15 | 20 | SEM |
| Initial body weight (g) | 136.20 | 130.33 | 136.87 | 132.67 | 134.07 | 1.44 |
| Final body weight(g) | $3023.30^{a}$ | $1840.00^{b}$ | $1180.00^{c}$ | $726.67^{d}$ | $504.43^{e}$ | 243.23 |
| Total weight gain(g) | $2887.20^{a}$ | $1709.70^{b}$ | $1044.80^{c}$ | $594.00^{d}$ | $370.37^{e}$ | 243.02 |
| Daily weight gain(g) | $58.90^{a}$ | $34.89^{b}$ | $21.31^{c}$ | $12.12^{d}$ | $7.56^{e}$ | 4.96 |
| Total feed intake(g) | $5543.30^{a}$ | $4663.00^{b}$ | $3413.50^{c}$ | $2428.0^{d}$ | $1870.30^{e}$ | 365.46 |
| Daily feed intake(g) | $113.23^{a}$ | $95.16^{b}$ | $69.47^{c}$ | $48.55^{d}$ | $38.09^{e}$ | 7.47 |
| Feed to gain ratio | $1.93^{e}$ | $2.73^{d}$ | $3.20^{c}$ | $4.11^{b}$ | $5.05^{a}$ | 0.29 |
| Mortality (%) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

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

There were significant differences ($p<0.05$) in all the parameters considered except for initial body weight and mortality. There was progressive loss in final body weight as the level of *mucuna* inclusion increased from 0% to 20% (Table 3). Control recorded the highest live body weight of 3023.30g while, birds fed diet with 20% m*ucuna* had the least body weight of 504.43g. Among the birds placed on the test diets, birds fed diet with 5% *mucuna* seed meal performed significantly ($P<0.05$) better (1840.00g) than other test diets. Birds fed diets with 10 and 15% *mucuna* had final body weight of 1180.00 and 726.67g, respectively. The progressive loss in weight was obvious early in the experiment and at 8 weeks of age the broiler fed 20% raw *Mucuna sloanei* based diet weighed only 504.43g (16.68% of the control) as against 1840.00, (60.86% of the control) for that fed 5%.*mucuna*.

This is in line with the report of Del Carmen *et al*. (1999) that there was progressive weight loss of broilers fed diet containing graded levels of raw *mucuna* as the level of *mucuna* inclusion increased. The loss in weight could be attributed to the effect of anti-nutritional factors such as saponin, tannin, HCN, L Dopa, trypsin inhibitors and others which inhibit growth. Malinow *et al.* (1987) reported that among the effect of saponin on animals are growth inhibition in swine and poultry. Cheeke and Shull (1985) reported retardation of growth rate in chicks and pigs due primarily to reduction in feed intake by bird fed diets containing high level of saponin. Tannin has been reported to be a toxic compound that causes poor palatability in diet containing high amount of tannin due to its astringent property because it binds with the protein of saliva and mucosa membranes (Ekwe, 2012).

Total weight gain (TWG), daily weight gain (DWG), total feed intake (TFI) and average daily feed intake (ADFI), all followed the same trend as final weight following same reason deduced for final weight gain. The control had TWG of 2887.20g DWG of 58.90, , TFI of 5543.30 and ADFI of 223.23g, levels of which was significantly ($P<0.05$) better than the mean values among the dietary treatments followed closely by birds fed diets containing 5% *mucuna* with values 1709.70g, 34.89g, 4663.00g, 95,16g for TWG, DWG, TFI, ADFI, respectively. Birds fed 20% *mucuna* based diets had the least values of 370.37g, 7.56g, 1870.30g, 38.09g for TWG, DWG, TFI, DFI followed by birds fed 15% and 10 % *mucuna* in that order which were not able to meet with the broiler standard in terms of TWG, DWG, TFI, and ADFI. The reason could be attributed to the negative influence of anti-nutritional factors in the raw *Mucuna sloanei* based diets. This result was in line with the findings of Emenalom and Udedibie (1998), Carew *et al*. ($2003_b$), Tuleun and Igba (2007) who reported that broiler chicks on 10% raw *Mucuna pruriens* balanced ration had depressed growth rate as a result of the presence of anti-nutritional factors in their ration. This same observation was also reported by Ekwe (2012) that the poor weight gain of birds on *mucuna* based ration would have been due to poor nutrient utilization resulting from the effect of anti-nutritional factors such as cyanogenic glucoside, trypsin inhibitor, tannin, phytin, and saponin that are present in the raw *mucuna* seed.

It has been observed that cyanogenic glucoside on hydrolysis releases hydrogen cyanide HCN) which has the ability to cause a marked weight reduction (Aletor, 1993). Akinmutimi (2004) reported that methionine deficiency in *mucuna* seeds result in poor growth of birds raised on *mucuna* based ration.

There were significant differences (P<0.05) across the different treatments for feed to gain ratio. The control performed better than all having the least feed to gain ratio of 1.93 followed closely by birds fed diet containing 5% *mucuna* (2. 73) while birds on diet with 20% *mucuna* had the worst feed to gain ratio (5.05) since the higher the feed to gain ratio the poorer the diet quality and the feed conversion efficiency ( Eburuaja, 2010). Feed to gain ratio (feed efficiency) is a measure with which a feed is being converted into useful animal products such as meat or egg. Therefore, it is not enough for one to know that a bird feeding on a particular diet produces more meat but one must ascertain how many units of meat such bird can produce from a unit feed intake. Based on the above, diet 1 (control diet) with FGR of 1.93 performed better than all followed by diet 2(diet with 5% *mucuna*) with value 2. 73.

There were no significant differences (P>0.05) across the different treatments for mortality. This shows that *mucuna* inclusion even up to 20% in the diet would not result to acute mortality of the birds. In conclusion, it was therefore observed that qualitative replacement of soybean meal with raw *Mucuna sloanei* seed even at 5% dietary inclusion level was deleterious to the growth of broiler chickens. *Mucuna sloanei* seed meal should not be included to broiler chicken diets up to 5%. Processing of *Mucuna sloanei* seed before inclusion into the diet of broiler is therefore recommended to improve performance.

The carcass yield (cut parts) of broiler finisher fed gradded levels of raw *Mucuna sloanei* seeds meals is presented in Table 4.

**Table 4: Carcass characteristics of finisher broiler chickens fed diets containing graded levels of raw *Mucuna* sloanei seed meal.**

| | Levels of raw *Mucuna* seed meal (%) | | | | | |
|---|---|---|---|---|---|---|
| | 0 | 5 | 10 | 15 | 20 | SEM |
| Parameters | | | | | | |
| Live weight (g) | 2883.30$^{a}$ | 1850.00$^{b}$ | 1116.70$^{c}$ | 716.67$^{d}$ | 533.33$^{e}$ | 230.51 |
| Defeathered weight(g) | 2733.3$^{a}$ | 1675.00$^{b}$ | 947.00$^{c}$ | 620.33$^{d}$ | 478.33$^{e}$ | 223.11 |
| Dressed weight (g) | 2156.70$^{a}$ | 1346.30$^{b}$ | 674.67$^{c}$ | 426.67$^{d}$ | 319.33$^{d}$ | 183.39 |
| Percent dressed wt (%) | 75.75$^{a}$ | 73.74$^{b}$ | 61.25$^{b}$ | 59.59$^{b}$ | 56.42$^{c}$ | 2.13 |
| Breast (%) | 30.60$^{a}$ | 27.71$^{ab}$ | 28.27$^{ab}$ | 26.67$^{b}$ | 25.60$^{b}$ | 0.57 |
| Thighs (%) | 18.10$^{a}$ | 15.73$^{b}$ | 15.72$^{b}$ | 15.99$^{b}$ | 15.04$^{b}$ | 0.33 |
| Drum stick (%) | 13.00$^{b}$ | 13.02$^{b}$ | 14.91$^{a}$ | 14.77$^{a}$ | 13.26$^{b}$ | 0.26 |
| Wings (%) | 10.79$^{c}$ | 11.15$^{c}$ | 14.00$^{ab}$ | 13.32$^{b}$ | 15.71$^{a}$ | 0.55 |
| Back cut (%) | 26.65 | 24.68 | 25.59 | 26.69 | 27.34 | 0.36 |

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

There were significant (P<0.05) differences in all the parameters considered except for back cut. The value of the live weight ranged from 533.33g (D5) to 2883.30g (D1). The live weight decreased significantly (P<0.05) as the quantity of *muuna* increased in the diet. This could be attributed to the increased concentration of anti-nutritional factors, and reduction in feed intake as the quantity of *muuna* increased. Feed intake is a major factor that influences weight gain (Plavinik *et al*., 1981; Ani and Okeke, 2003; Ani and Okafor, 2004). The defeathered weight followed similar trend as that of live weight. This shows that the major proportion of the live weight was not only feathers. The dressed weight followed similar trend as that of the defeathered weight in that there was progressive decrease in weight from

2156.70g (D1) to 319.33g (D5) as dietary level of the raw *mucuna* increased. Percentage dressed weight was significantly (P<0.05) higher in D1 (75.25%), followed by treatments 2, 3, and 4 (73.74%, 61.25%, and 59.59%), respectively, whose values were not significantly different (P>0.05), while D5 had the least weight of 56.42%. The high percentage dressed weight of D1 over others implies that the composition of the dressed weight is not made up of inedible offal (Oluyemi and Robert, 2000). There was comparable (P<0.05) values for percentage breast weight for D1(30.60%), D2(27.71%), D3(28.27%) while D4 and D5 had comparable values (26.67% and 25.60%) that compared favourably with D2, D3 but significantly (P<0.05) lower than D1. For percentage thigh weight, D2, D3, D4, and D5 were not significantly different (P>0.06) as they varied from 15.04% to 15.99% which were significantly (P<0.05) lower than that of the control (18.10%). Percentage drumstick of D3 and D4 (14.91% and 14.77%) were statistically higher than others. The percentage wing weight of D5 (15. 71%) was significantly higher (P<0.05) than D1, D2 and D4 but comparable with D3.

Considering the live weight, defeathered weight, dressed weight and percentage dressed weight, breast and thigh one can affirm that the control exhibited superior performance over the raw *Mucuna sloanei* seed meal. This may be due to efficient utilization of nutrient, absorption and assimilation (Bamgbose *et al*., 1998).

The effect of the use of *Mucuna sloanei* seed meal on the economics of production of broiler birds is in Table 5.

**Table 5: Economics of production of broiler chicken fed diets containing graded levels of raw *Mucuna sloanei* seed meal**

| | Levels of raw *Mucuna sloanei* seed meal (%) | | | | | |
|---|---|---|---|---|---|---|
| | 0 | 5 | 10 | 15 | 20 | SEM |
| Parameters | | | | | | |
| Cost of feed consumed (₦) | 532.20$^{a}$ | 493.40$^{b}$ | 395.27$^{c}$ | 305.48$^{d}$ | 254.77$^{e}$ | 28.44 |
| Cost /kg feed (₦) | 95.92$^{e}$ | 105.81$^{d}$ | 115.80$^{c}$ | 125.82$^{b}$ | 136.22$^{a}$ | 1.26 |
| Cost /kg wt gain (₦) | 184.44$^{e}$ | 288.55$^{d}$ | 379.10$^{c}$ | 518.19$^{b}$ | 685.09$^{a}$ | 47.32 |
| Revenue (₦) | 1992.00$^{a}$ | 1077.10$^{b}$ | 547.73$^{c}$ | 341.33$^{c}$ | 255.47$^{c}$ | 175.73 |
| Gross margin (₦) | 1459.80$^{a}$ | 583.66$^{b}$ | 152.47$^{c}$ | 35.91$^{c}$ | 14.20$^{c}$ | 150.55 |

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

The result revealed significant (P<0.05) difference across the dietary treatments means for all the parameters considered. The control diet had the lowest cost of feed (₦N184.44) per kilogram weight gain of meat, followed by D2 (₦288.55), D3 (₦ 379.10), D4 (₦518.19), and D5 (₦685.09.). It was also observed that the cost of total feed consumed by birds on the control diet ranked highest (₦532.20) closely followed by D2 (₦493.40), D3 (₦395.27), D4 (₦305.48), and lastly by D5 (₦254. 77). This can be associated to reduction in the feed intake as the quantity of raw *mucuna* in the test diet increased as a result of increased in concentration of anti-nutritional factors and indigestible fibre content of the test diets.

The progressive increase in the cost per kg weight gain shows that the birds ate more to gain less. This can be implicated to the negative effect of the anti-nutritional factors that limits the availability of nutrients to the birds in the test diets. The control had the

highest return (D1= ₦1992.00) closely followed by D2(₦1077.10) and then D3(₦547. 73), D4(₦341.33), and D5(₦255.47). The significantly ($P<0.05$) lower values of the test diets from that of the control could be attributed to the progressive lower final body weight and lower total weight gain of birds placed on these test diets. They consumed less feed, which could not be efficiently utilized by the body for growth due to the presence of anti –nutritional factors in the test diets. This result to low gross margin of the test diets (D2= ₦583.66, D3=₦152.47, D4=₦35.91, D5= N14.20) as compared to that of the control (D1= N1459.80).

The fact that the control diet had the least cost per Kg weight gain and attracted highest revenue and gross margin shows that incorporating raw *mucuna* in the diet of broiler chicken even at 5% seemed not economically advantageous

Considering the poor performances of birds fed *mucuna* based diets in relation to the growth performance, carcass cut parts, organ weight, haematology, serum blood biochemistry, and economics of returns, raw *mucuna* seed meal cannot replace soya bean based diet even at 5% level of inclusion without being detrimental to health.

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