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# Haematology, serum and organ weight of broiler chickens fed boiled mucuna sloanei seed meal treated with enzyme

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***Target Audience**:* Poultry Farmers, Nutritionist, Feed Manufacturers, Animal Physiologist

## Abstract

*The haematology, serum and organ weight of broiler chickens fed boiled Mucunasloanei seed meal mixed with enzyme was investigated. The experiment was conducted with140 Anak broiler chickens divided into 3 treatments of 3 replicates and 10 birds per replicate. Birds fed diet 2 {7.5% boiled Mucuna mixed with enzyme (BME)} had higher final body weight of 2216.70g. The test diets gave lower total feed in-take value that was significantly (P< 0.05) lower than that of the control. Diet 2 (D2) gave the bestfeed-to-gain ratio (1.72) that was significantly (P<0.05) different from those of the control (2.09), diet 3 (D3)(2.08) and diet 4(2.27). For the carcass characteristics, D2 compared favourably with the control for percent dressed weight and back cut. The control had the lowest value for kidney and gizzard weights while D3 had the lowest weight of spleen. Serum albumin, urea, and creatinine were significantly (P<0.05) affected. Diet 2 and 3 had a higher (P<0.05) than that of the control diet (2.67g/dl. Diet 2 had urea content (19.66mg/dl that was lower (P<0.05) than those of diet3 (23.67mg/dl) and 4(25.67mg/dl) but compared with that of the control diet919.00mg/dl). For creatinine value D3and D4 compared with D1 but significantly (p<0.05) lower than D2.Urea concentration was increased as the percentage inclusion of MSS boiled and mixed with Maxi-grain enzyme increased from 0 to 12.5%. In conclusion, 7.5% of boiled Mucuna sloanei seed meal treated with enzyme (Maxi-grain) is recommended for inclusion in broiler ration since the birds placed on this ration were able to perform better than those fed with the conventional soya meal based ration.*

***Keyword:*** mucuna haematology, serum, organ, broiler chicken, Maxi-grain.

## Description of problems

The increase in price of feed ingredients in developing countries has greatly reduced the rate of expansion of the poultry industry. Hence, the protein intake of Nigerians has been on a decline as a result of the ever - increasing population. This level of animal protein consumption has direct influence on the general well-being and health of the populace. Poultry production, especially the broiler chicken remains one of the veritable ways of achieving quality protein to meet the increasing demand of the Nigerian teeming populace (1) due to the short generation interval of broiler chickens (2). Feed cost alone in the poultry industry is about 70% of the total cost of production which has been attributed to over -dependence on the conventional

feedstuffs such as soyabean and groundnut cake (3). A high demand for these feed ingredients has resulted in an increase in price of the products (3). Hence, the need to source for alternative but promising feedstuffs. One of the promising ways to solving the above is to identify cheaper and available feed stuffs that are of low human preference and of little or no industrial use that can meet nutritional requirements of poultry with or without processing (3; 4). One of the grain legumes that have such potential is Velvet bean(*Mucuna sloanei*) *(*3). Different authors have reported the nutritional values (5, 6). *Mucuna sloanei*, commonly called Horse-eye bean is consumed locally and in many cases, it appears to be a last resort legume in circumstances of famine or scarcity of more popular legumes (7). The seeds are highly resistant to disease and pest, and have good nutritional qualities. It yields about 0.8 to 2 tons of seeds/ha with crude protein content of about 28% (8). The use of *Mucuna sloanei* leaves or seeds as a source of plant protein for Non-ruminant animals could be limited by its reported anti-nutritional factors with possible chronic toxic effects (9). The enzyme used in this study is Maxi-grain; The role of enzymes as feed additive in poultry diets is well established. (10; 11). Maxi-grain has been identified to optimize the use of non-conventional feed ingredients by improving weight gain and feed conversion ratio in broilers, improve litter quality and egg production as well as shell quality (12; 13) It also reduces levels of dicalcium phosphate incorporation in the feed substantially. The broad objective of this work is to determine the effect of boiled *Mucuna sloanei* seed meal based diet supplemented with maxi-grain enzymes on the performance of broilers chicken: effect on haematology serum biochemistry, and organ weight. It was therefore concluded that boiled *Mucuna sloanei* seed meal treated with enzyme (Maxi-grain) be included in broiler ration since it is cheap, readily available, not being competed for by man and industry, have good protein and energy value. Also boiling is one of the common methods used to detoxify legumes to make their nutrient content available to the animal based ration.

**Materials and methods**

One hundred and twenty (120) one-week old broiler chickens were randomly assigned to 4 treatment diets in a completely randomized experiment that lasted for 49 days. 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 diet 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 measured quantity of feed every day and on the following day the left over was 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. Four experimental diets were formulated (D, D2, D3, D4) crude protein range from 22.10 to 22.28% and energy level ranged from 2859.25 to 3003.60Kcal/kg)(Table 1).

**Table 1: composition of experimental diets. Levels of inclusion of *M. sloanei***

| Ingredients | 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 |
| *Mucuna sloanei* | - | 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 |
| Vitamin premix | 0.25 | 0.25 | 0.25 | 0.25 |
| Common Salt | 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 |
| MetabolizableEnergy(Kcal/Kg) | 3003.60 | 2977.35 | 2968.60 | 2859.85 |

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). 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 in diets 2,3 and 4

**Data collection**

At the end of the experiment, two birds having weight similar to the average weight of birds in the replicates were selected from each replicate. They were slaughtered by making an incision through the jugular vein, bled and defeathered after dipping in warm water (50-60$^{o}$C). Offal and visceral were separated. The organs (heart, kidney, liver, spleen, gizzard and intestine) were weighed separately using electronic micrometer 5000g weighing gauge and expressed as percentage of live weight.

**Determination of blood parameters**

Blood samples were collected twice (4$^{th}$ week and 7$^{th}$ week) through the wing vein using a sterile syringe and needle. Blood sample per chicken was collected into two sets of labeled sterile bottles. One set contained anti-coagulant (EDTA – Ethyl-diamine tetra acetic acid powder), while, the other set did not. The set of bottles containing anti-coagulant was used to determine the values of haematological indices such as size of red blood cell (RBC), white blood cell (WBC), haemoglobin (Hb), packed cell volume (PCV) and red blood cell count. Values obtained were used to calculate Mean corpuscular volume (MCV), Mean corpuscular haemoglobin (MCH), Mean Corposcular Haemoglobin Concentration (MCHC).

$$\text{Mean corpuscular volume (MCV)} = \frac{\text{PCV x 10}}{\text{RBC}}$$

$$\text{Mean corpuscular haemoglobin MCH)} = \frac{\text{Hb x 10}}{\text{RBC}}$$

Mean Corposcular Haemoglobin Concentration (MCHC)
= Hb x 100
PCV

The set of bottles without anti-coagulant was used to determine the biochemical indices such as total protein, albumin, serum alkaline phosphatase, serum creatinine, and urea.

**Experimental design and statistical analysis**

The experimental design used was a completely randomized design (CRD). The model is shown as follows:

$Yij = \mu+T_1+eij$

Where Yij = single observation (i.e the $j^{th}$ observation of $i^{th}$ treatment)

$\mu$ = overall mean

$T_1$= effect of treatment/factor of interest

Eij = the random error or residual error

$Eijk = iind (O, r^2)$

The random error is independently, identically and normally distributed.

Data collected were subjected to analysis of variance (ANOVA) as was described by Steel and (14), and significant means were separated using Duncan Multiple Range Test (15).

**Results and Discussion**

Table 2 revealed the organ weights expressed as percentage of live weight of finisher broiler chicken fed diets containing varying levels of *Mucuna* seed meal boiled for 30 minutes and mixed with maxi-grain.

**Table 2: Organ weight expressed as percentage of live weight of finisher broiler chickens fed diets containing varying levels of boiled *Mucuna* seed mixed with enzyme.**

| | Levels of BME(%) | | | | |
|---|---|---|---|---|---|
| Parameters | 0 | 7.5 | 10 | 12.5 | +SEM |
| Liver(%) | 1.98 | 2.25 | 1.96 | 2.09 | 0.07 |
| Heart (%) | 0.51 | 0.51 | 0.53 | 0.51 | 0.02 |
| Empty gizzard (%) | $1.95^{b}$ | $2.25^{ab}$ | $2.43^{a}$ | $2.19^{ab}$ | 0.07 |
| Kidney (%) | $0.71^{b}$ | $0.87^{ab}$ | $0.89^{a}$ | $0.96^{a}$ | 0.13 |
| Intestine (%) | 3.99 | 4.49 | 4.75 | 4.86 | 0.18 |
| Gall bladder (%) | 0.19 | 0.18 | 0.18 | 0.19 | 0.02 |
| Spleen (%) | $0.15^{ab}$ | $0.16^{ab}$ | $0.14^{b}$ | $0.21^{a}$ | 0.01 |
| Proventriculus (%) | 0.58 | 0.56 | 0.69 | 0.64 | 0.02 |
| Lungs (%) | 0.68 | 0.76 | 0.72 | 0.63 | 0.03 |

$^{a,b}$Means within the same row with different superscripts are significantly (P< 0.05) different .SEM- Standard error of mean. 0%=Diet1 containing 0% *mucuna*, 7.5%= Diet2 containig 7.5%*Mucuna*, 10%= Diet3 containing 10% *Mucuna*, 12.5%= Diet4 containig 12.5% *Mucuna*. *BME=boiled mucuna and mix with enzyme*

There were no significant difference in all the parameters except for gizzard, kidney and spleen. The weight of the gizzard ranged from 1.95% in D1 to 2.43% in D3. The value of D1 compared favourably with that of D2 (2.25%) and D4 (2.19%) but significantly (P<0.05) lower than that of D3. This is in line with the findings of (12) that enzyme supplementation of broiler diets reduced gizzard weight. Higher dietary fibre would promote higher thickening of the muscles (16). Higher gizzard weight in broilers may be related to higher dietary fibre content (17).

The value for the kidney revealed that D2 (0.87%) was not significantly different (P>0.05) from D1 (0. 71%) and that D3 and D4 had higher values of 0.89% and 0.96%, respectively than that of the control (D1). The

increase in the weight of the kidney in D3 and D4 can be attributed to increase in activity since the key enzyme in cyanide detoxification (rhodanase) is mainly in the kidney (18).

The spleen value showed that D2 and D4was not significantly different (P>0.05) from D1, and they had values that were significantly (P<0.05) higher that of D3 . This shows that the birds have balanced energy and protein for proper development because low spleen value has been associated with deficiency of both energy and protein in broiler diet (19).

Haematological indicies of 8 -week old broiler chickens fed diets containing varying levels of *Mucunasloanei* seed cooked for 30 minutes and mixed with enzyme are shown in Table 3.

**Table 3. Haematological indicies of broiler chickens fed diets containing varying levels of *Mucuna sloanei* seed boiled for 30 minutes and mixed with enzyme (BME)**

| | Levels of BME in the diets (%) | | | | |
|---|---|---|---|---|---|
| Parameters | 0 | 7.5 | 10 | 12.5 | +SEM |
| Hb (g/dl) | 12.47$^{a}$ | 12.87$^{a}$ | 11.00$^{b}$ | 10.00$^{b}$ | 0.34 |
| PCV (%) | 35.00$^{b}$ | 38.67$^{a}$ | 33.00$^{b}$ | 32.00$^{b}$ | 0.89 |
| WBC (x10$^{3}$/cm$^{3}$) | 5.63$^{bc}$ | 8.47$^{a}$ | 3.50$^{c}$ | 7.80$^{ab}$ | 0.66 |
| RBC (x10$^{6}$/cm$^{3}$) | 4.00$^{a}$ | 3.77$^{ab}$ | 3.37$^{b}$ | 3.47$^{b}$ | 0.10 |
| MCV (fl) | 87.50$^{b}$ | 111.80$^{a}$ | 98.75$^{ab}$ | 92.40$^{b}$ | 3.65 |
| MCH (pg) | 31.18$^{ab}$ | 37.18$^{a}$ | 32.92$^{ab}$ | 30.33$^{b}$ | 1.14 |
| MCHC (%) | 35.33 | 36.51 | 33.33 | 32.81 | 0.86 |

$^{a,b,c}$Means within the same row with different superscripts are significantly (P< 0.05) different .SEM=Standard error of mean
WBC = white blood cell, RBC= red blood cell, MCH = mean corpuscular haemoglobin, mean corpuscular haemoglobin concentration, MCV= mean corpuscular volume

The result revealed significant (P<0.05) differences in all the parameters except for MCHC. The haemoglobin value of D2(12.87g/dl) was not significantly different (P>0.05) from the control (12.467g/dl) and both were significantly higher (P<0.05) than that of D3(11.000g/d/and D4(10.000g/dl). The haemoglobin values across the various treatment means were all within the normal range for broiler chicken as reported by (20) and (21). The PVC values ranged from 32.00% in D4 to 38.67% in D2. Notwithstanding the significant (P<0.05) differences that existed among the treatment means, the PVC values in all the treatments were within the normal range for broiler chicken as was reported by(20) and (21).

The WBC, RBC, MCV, MCH, and MCHC all fell within the normal range for broiler chickens as was recommended by (20), and (21), confirming the positive effect of the enzyme across the various treatments in reducing the toxicity (anti-nutritional factors) of the *Mucuna sloanei*seedto a level that could be tolerated by broiler chickens. D2 (.7.5% level of boiled *Mucuna* seed inclusion) is chosen as the best since it gave the best result among the test dietary treatments, and compared favourably with the control in all the heamatological parameters.

Table 4. showed the serum biochemical indices of 8 weeks old broiler chicken fed varying levels of *Mucuna sloanei* seed cooked for 30 minutes and mixed with Maxi-grain multi-enzyme.

**Table 4: Serum biochemical indices of broiler chickens fed diets containing varying levels of *Mucuna sloanei* seed boiled for 30 minutes and mixed with Maxi-grain multi-enzyme (BME)**

| Parameters | Graded levels of BME (%) 0 | 7.55 | 10 | 12.5 | +SEM |
|---|---|---|---|---|---|
| Total protein(g/dl) | 5.80 | 6.07 | 6.07 | 6.10 | 0.07 |
| Albumin (g/dl) | 2.67[c] | 2.97[c] | 3.40[a] | 3.00[b] | 0.09 |
| Urea (mg/dl) | 19.00[c] | 19.66[c] | 23.67[b] | 25.67[a] | 0.87 |
| Creatinine (mg/dl) | 0.80[b] | 1.17[a] | 0.87[b] | 0.80[b] | 0.05 |
| Alkaline Phosphatase (iu) | 114.67 | 105.00 | 138.00 | 122.67 | 9.04 |
| Globulin (g/dl) | 3.13 | 3.10 | 2.33 | 2. 70 | 0.14 |

[a,b,c]Means within the same row with different superscripts are significantly (P< 0.05) different .SEM= Standard error of mean

*BME=Boiled Mucuna m*ixed with Enzyme

Significant differences (P<0.05) existed in the following parameters: albumin, urea, and creatinine but not in total protein and alkaline phosphatase.

The value of the albumin content showed that D2 (2.97g/dl) was not significantly different from D1=2.67g/dl. D3 was the highest (P<0.05) among the treatments followed closely by D4 and both were significantly (P<0.05) higher than D1 and D2. For the urea content, D2 was not significantly different (P>0.05) from D1. However, both were significantly (P<0.05) lower than D3 and D4. The highest urea value was found in D4 and closely followed by D3. High value of urea concentration is an indication of poor quality protein of the diet (22; 18). The creatinine value revealed that D1, D3 and D4 were similar (P>0.05) but were significantly (P<0.05) lower than D2.

Notwithstanding, the significant differences existed among the various treatment means for albumin, urea and creatinine. However, the values were within the normal range for broiler chickens as was reported by (20), and (21). However considering the similarities of D2 with the control for albumin and urea content, D2 was chosen as the best.

**Conclusion and Application**

1. It was therefore concluded that 7.5% of boiled *Mucuna sloanei* seed meal treated with enzyme (Maxi-grain)could be included in broiler ration since the birds placed on this ration were able to perform better than those fed with the conventional soya meal based ration.
2. That higher percentage (above 7.5%) of *Mucuna sloanei* seed meal mixed with Maxi- grain enzyme could be included in broiler ration. This will go a long way to reducing the over independence on the scarce, costly and highly competed conventional protein source for broiler ration like soya bean meal.
3. That other methods of detoxification could be employed such as boiling and dehulling, fermentation, toasting and mixing with enzyme, and other enzymes could also be used for detoxification.

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