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THE FEED VALUE OF TOASTED *MUCUNA SLOANEI* MEAL ON THE PERFORMANCE, HAEMATOLOGY AND BLOOD BIOCHEMISTRY OF BROILER FINISHER BIRDS

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ABSTRACT

An experiment was conducted to determine the feed value of toasted Mucuna sloanei meal (TMSM) on the performance, haematology and blood biochemistry of broiler finisher birds. Mucuna sloanei seeds were processed into toasted Mucuna sloanei meal (TMSM) and analyzed for proximate and phytochemical composition. The meal was then used to formulate broiler finisher diets at 0.0, 5.0, 10.0 and 15.0% inclusion levels respectively, which were then used to raise groups of 30 broiler finisher for 5 weeks. At the end of the 5 weeks (35 days) feeding trial, 3 birds were selected from each group and used for the determination of the blood indices. The daily feed intake and feed conversion ratio increased significantly ($P < 0.05$) as the dietary levels of TMSM increased. The cost of production also increased as the TMSM increased. The haemoglobin (HB), the packed cell volume and the red blood cell decreased significantly at 15.0% dietary levels. The total proteins, creatinine, urea, cholesterol and serum glutamic oxaloacetic transaminase (SGOT) decreased significantly as toasted Mucuna sloanei meal increased. The results of this trial suggests that broiler finisher chicken can be fed with the toasted Mucuna sloanei meal up to 5.0% inclusion level in their diets without any detrimental effects on performance and blood indices.

Key words: feed value, toasted *Mucuna*, haematology, blood biochemistry
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INTRODUCTION

The most critical challenge of the livestock and poultry industry is the provision of good quality feed for the animals. Quality feeds are expensive because most of the constituent feed materials such as soya bean, maize, fish meal, groundnut cake etc, are utilized not only by the animals but by humans and industries as well. Competition for these feed items (especially protein feeds such as soya bean) sky rockets the price, leading to high cost of production and consequently high cost of poultry products. Soya bean is an oil seed legume, high in protein (about 44 – 47% CP) and forms the major source of plant protein for non-ruminants especially poultry

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constituting about 15 – 25% level of inclusion in poultry ration. The over dependence on soya bean as major protein source for monogastric animal feeding and industrial purposes has increased its scarcity and consequent high cost of production. There is need therefore, to investigate some other legume seeds that are rich in protein and have the potential to either partially or wholly replace soya bean in poultry ration and support the growth and life of the poultry industry. *Mucuna sloanei* is one of those promising legumes that is rich in protein and may serve as an alternative to soya bean. *Mucuna sloanei* seeds are used in south eastern part of Nigeria as condiment and for thickening of soup (Uzomah and Odusanya, 2011). It yields about 0.8 – 2 tonnes of seeds per hectare with crude protein of about 28% (Ijeh *et al.*, 2004). Uzomah and Odusanya (2011) reported 23.92% CP, 3.18% CF, 6.57% EE, 1.95% ash and 55.19% carbohydrate for *Mucuna sloanei*. Igbabul *et al.*, (2012) reported different values for the proximate composition when fermented for 24hrs, 48hrs, and 72hrs. He reported 15.31% CP for toasted *Mucuna sloanei* and 13.12% CP, 15.31% CP and 32.82% CP respectively for 24hrs, 48hrs and 72hrs fermentation, crude fat was 6.0% (unfermented), 6.5%, 4.0% and 5.0% respectively for 24hrs, 48hrs and 72hrs fermentation. Ash % were 1.8 (unfermented), 1.6, 0.8 and 1.0 respectively for 24hrs, 48hrs and 72hrs fermentation and carbohydrate (%) were 69.82 (unfermented) and 70.48, 72.29 and 51.59 respectively for 24hrs, 48hrs and 72hrs fermentation. One of the major limiting factors of legume utilization is the presence of anti-nutritional factors (Oke *et al.*, 2002). Similar to other legumes, *mucuna* grains possess anti-nutritional factors such as L-DOPA, tannins, trypsin inhibitors etc. (Akinmutimi and Okwu, 2006). The need to process the seeds in order to reduce the effect of some of these anti-nutrients becomes very necessary. Yagoub and Abdalla (2007) reported that soaking, dehulling and roasting improved the nutritional and functional properties of plant seeds. Toasting is one of the traditional ways of detoxifying feed items before use. Adetola, *et al.* (2016) reported that toasted Seasame seed meal was beneficial to broiler performance at 25% dietary level of inclusion for the parameters measured. Raji *et al.*, (2014) reported that toasting had a significant reduction effect on the anti-nutritional factors of African yam bean. Several researchers have reported that most anti-nutritional factors in legume seeds can be reduced by proper application of heat (Farris and Singhs, 1990; Balogun *et al.*, 2001;).

This study therefore was aimed at investigating the feed value of toasted *mucuna sloanei* meal on performance, carcass characteristics, haematology and serum biochemistry of finisher broiler birds.

MATERIALS AND METHODS

Source and processing of *Mucuna sloanei* seeds

The *Mucuna sloanei* seeds were bought from a reputable source in Afo Oru market in Ahiazu Mbaise LGA of Imo State. The seeds were dehulled manually by cracking with hammer and the seeds were sorted to remove bad ones. Thereafter, the seeds were soaked in water for 24 hours,

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washed and sun dried for 7 days. The sun dried seeds were toasted for 1 hour at 45 – 50^0c and milled in a hammer mill to obtain a fine powdery toasted *mucuna sloanei* meal. Samples of the meal were subjected to proximate and phytochemical analysis according to AOAC (2010).

Experimental diets

Four finisher broiler diets were compounded, incorporating toasted *mucuna sloanei seed* meal (TMSM) at 0%, 5.0%, 10.0% and 15.0% inclusion levels respectively, partly replacing soya bean in the control diet. The diets were thus designated as T_0, $T_{5.0}$, $T_{10.0}$ and $T_{15.0}$ respectively. The ingredients and calculated nutrient composition of the diets are shown in table 1.

Experimental birds and design

One hundred and twenty (120) four-weeks old Rox 308 broiler chicks bought from a reputable dealer in Owerri were used for the trial. The birds were randomly divided into four groups of 30 broilers and each group randomly assigned to one of the four treatment diets in a completely randomized design (CRD). Each group was further subdivided into three replicates of 10 broilers each and each replicate housed in a deep litter compartment measuring 1m×1.5m. Feed and water were provided *ad libitum*. The trial lasted for 35 days.

Data collection

The birds were weighed at the beginning of the experiment to obtain their initial body weights and weekly, thereafter. Daily feed intake was determined by subtracting the weight of leftover feed from the weight of the feed given the previous day. Data were collected on feed intake, body weight changes and feed conversion ratio. Feed conversion ratio was calculated by dividing the average daily feed intake by average daily weight gain.

Haematology and Blood Biochemistry

At the end of the 35 day feeding trial, blood samples were collected from 3 birds from each treatment and 2mls of blood placed in the specimen bottles with Ethylene diamine tetra acetic acid (EDTA) and 5mls of blood placed in the specimen bottle without EDTA for haematological and blood biochemical indices, respectively. Blood was analyzed within 3 hours of collection for red blood cell (RBC) count, haemoglobin concentration (HB), white blood cell count (WBC), packed cell volume (PCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), mean corpuscular volume (MCV) and differential WBC counts as outlined by Ochei and Kolhatkar (2000). Blood biochemical indices analyzed included total protein, cholesterol, urea, creatinine, enzymes and the electrolytes sodium, potassium, carbonate and chloride (Ochei and Kolhatkar, 2000).

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Statistical Analysis

Data collected were subjected to analysis of variance using the SPSS software (2012). Where analysis of variance indicated significant treatment effects, means were compared using Duncan's New Multiple Range Test (DNMRT) (SPSS, 2012)

RESULTS AND DISCUSSION

Proximate composition

The proximate and phytochemical composition of the toasted *Mucuna sloanei* meal (TMSM) are shown in table 2. The crude protein, crude fibre, ether extract and ash percent were very close to the values reported by Afolabi, *et al*., (1985). The crude protein of 22.12% was also similar to the values reported by Akpata and Miachi (2001) and Uzomah and Odusanya (2011). The presence of anti-nutritional factors in the toasted *Mucuna* seed confirms the report that *Mucuna sloanei* possesses anti-nutrients (Akinmutimi and Okwu, 2006). The presence of these anti-nutrients after toasting implies that toasting can only reduce their quantity but cannot completely eliminate it.

Performance of the finisher broilers

The performance of the experimental finisher broilers are shown in table 3. The average final live weight of the birds decreased ($P < 0.05$) with increasing levels of TMSM. The decrease in weight could be attributed to the tannin and phytate content of TMSM which may have increased with increasing dietary levels. These anti-nutritional factors have been reported to reduce growth rate of broilers due to reduced protein and specific amino acids utilization (Elkin *et al*., 1995). There was no treatment effect ($P > 0.05$) on the average daily weight gain. The average daily feed intake increased significantly ($P < 0.05$) with inclusion of the toasted *Mucuna sloanei* meal. It is possible that toasting may have made the feed more palatable to consume. This is contrary to the report of Akinmutimi *et al*., (2011). Feed conversion ratio (FCR) increased significantly ($P < 0.05$) at 10.0 and 15.0% dietary levels of TMSM. T_2 (5%) dietary level gave a feed conversion ratio that is statistically similar to the control but significantly superior ($P < 0.05$) to other *Mucuna* groups. The feed conversion ratio was comparable to the values of Emenalom *et al*., (2009) on *Mucuna pruniens*. A lower feed conversion ratio implies better performance and effective utilization of the feed. T_2 (5.0%) dietary level of TMSM which showed a FCR comparable to the control is the optimum point of the feed utilization. Cost of production also increased with increasing dietary levels of toasted *Mucuna sloanei* meal. However, cost of production is determined by the season, the forces of demand and supply and the level of production of *Mucuna sloanei* within the local farming environment.

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Haematology and blood biochemistry

The results of the haematological and blood biochemical indices of broiler finishers fed TMSM are shown in table 4. Result showed that the haemoglobin (HB), packed cell volume (PVC) and red blood cell (RBC) were affected by treatments, being significantly decreased ($P < 0.05$) at 15% dietary level. Haemoglobin is an important determinant of anaemia (Wikivet, 2013e). Low values of RBC and HB could be a sign of anaemia (Mohammed and Oloyede, 2009). However, Teuleun *et al*., (2009) reported that *Mucuna* seeds have no adverse effect on the RBC indices in broiler chickens. The values obtained for haemoglobin (11.9 – 13.1 gldl) were higher than the values (7.10 – 10.10) reported by Aguihe *et al*., (2014) and within the normal ranges (11.60 – 13.68) reported by Wikivet (2013). The red blood cell values ($11.7 – 12.8 \times 10^{12}$/L) were within the normal range (Wikivet haematology, 2013). The packed cell volume (PVC %), is the volume percent of red blood cells in blood (Purves *et al*., 2004). A decrease in the PCV below the normal range was an indication of common conditions such as liver and kidney disease, malnutrion of vitamin B_{12} and folic acid deficiencies etc. (Demoranville and Best, 2013). The normal values of the PCV and haemoglobin implies a normal physiological functioning and effective circulatory gaseous exchange within the blood. The values from this study (37.7 – 42.3%) were higher than the values, 16.00 – 19.00% and 23. 32 – 32.33% reported by Ukpabi, *et al*., (2015) and Odetola *et al*., (2015) respectively for broiler finishers and within the normal range 35.9 – 41.0% reported by Wikivet (2013). In other words, the TMSM had no adverse effect on the serum, HB, RBC and PCV despite the significant decrease at 15.0% dietary level. However, it is possible that higher levels above 15.0%, may show an adverse effect in the values of HB, RBC and PCV. The white blood cell and its differentials (neutrophils, eosinophils, basophils, moncytes and lymphocytes) were not affected by treatments ($P > 0.05$). This implies that the feed of the toasted *Mucuna sloanei* meal did not produce any harmful effect in the blood of the birds as to cause abnormal rise in the serum WBC. Valencia (2012) reported that a high WBC could be caused by infection, immune system disorder, stress etc. Similarly, high leucocytes may be due to anaemia, bone marrow disorder, infectious disease, inflammatory disease, severe physical stress, tissue damage etc. (Dinaiers, 2008; Dugbale, 2011). The mean cell volume (MCV), mean cell haemoglobin (MCH) and mean cell haemoglobin concentration (MCHC) did not show any treatment effect. This implies that there was no negative effect of the diet on the blood constituent of the birds. Total proteins ranged from 55.30 to 61.30 (gldl). It was significantly decreased ($P < 0.05$) as the toasted *Mucuna sloanei* meal increased. Decreased serum protein concentration is a pointer to an interference on normal protein metabolism and protein utilization (Schukla and Pachaurii, 1995; Bolu and Balogun, 2009). The significant reduction in serum protein of birds on dietary treatments could be attributed to amino acid imbalance due to anti-nutrient such as tannins, saponins, alkaloids etc. that is capable of inhibiting proper nutrient utilization especially protein and iron necessary for red blood cell formation. Serum creatinine ranged from 20.70 to 24.30 (mmol/L). It decreased significantly ($P < 0.05$) as the TMSM increased. Excess creatinine in the

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blood of animals is from muscle when wasting occurs and creatinine phosphate is catabolized (Yuegang *et al*., 2008). Creatinine is an indicator of the extent of muscle wastage. High level of creatinine are sometimes seen in kidney diseases due to its function of excreting creatinine, muscle degeneration and exposure to toxic compounds which impair kidney function (Ologhobo *et al*., 1993). Significant reduction in values of creatinine is an indication of no muscle wastage as a result of inadequacy of protein in birds. Serum urea decreased significantly ($P < 0.05$) as the dietary intake of TMSM increased. This is in line with the findings of Agbabiaka *et al*., (2013) who reported a decrease in urea content of the blood of broiler finisher fed raw tiger nut based diets. High level of urea is an indication of low protein quality as a result of imbalance of amino acids (Nworgu *et al*., 2007) and is highly correlated with liver damage (NRC, 1994). Significant reduction in serum urea level as TMSM increased revealed that the diet had no deleterious effect on the protein quality. The dietary treatments did not affect the blood urea and creatinine of the birds. This is a pointer to no kidney dysfunction and better protein utilization. Serum cholesterol decreased significantly ($P < 0.05$) as dietary TMSM increased. This is contrary to the report of Ukpabi *et al*., (2015) for broiler finishers fed raw *Adenanthera Pavonina* seed meal. Reduced cholesterol implies that TMSM could be used to produce low cholesterol meats. Serum enzyme activities are used to monitor protein quality, assess toxicity and damages done to the liver. There was no treatment effect on the enzymes, alanine amino transferase (ALT) and serum glutamic pyruvic transaminase (SGPT). Serum glutamic oxaloacetic transaminase (SGOT) decreased significantly ($P < 0.05$) as the TMSM increased. Lower values of the liver enzymes showed that the diets were not toxic and damaging to the blood and liver of the broilers.

CONCLUSION

The results of the trial have shown that toasted *Mucuna sloanei* meal can serve as feed ingredient for broiler finishers at not more than 5.0% level.

Dietary levels of 10.0% and 15.0% resulted in poor weight gain, poor feed conversion ratio and high cost of production at the moment.

It has also shown that within this range of inclusion of toasted *Mucuna sloanei* meal, that is, 5.0 – 15.0% dietary levels, there was no adverse effect on the blood indices of broiler finishers.

It is therefore concluded that for optimal broiler growth, 5.0% dietary levels of toasted *Mucuna sloanei* meal is recommended.

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Table 1: Ingredient composition of the experimental diets (kg)

	Dietary levels of TMSM (%)			
Ingredients	**T_1(0%)**	**T_2(5.0%)**	**T_3(10.0%)**	**T_4(15.0%)**
Maize	55	55	55	55
Soya bean	20	15	10	5
Toasted *Mucuna sloanei*	0	5	10	15
Groundnut cake	6	6	6	6
Fish meal	2.0	2.0	2.0	2.0
Blood meal	2.0	2.0	2.0	2.0
Palm kernel cake	5.2	5.2	5.2	5.2
Wheat offal	5.0	5.0	5.0	5.0
Bone meal	4.0	4.0	4.0	4.0
Salt	0.30	0.30	0.30	0.30
*Vitamin premix	0.25	0.25	0.25	0.25
DL-Methionine	0.10	0.10	0.10	0.10
L-lysine	0.15	0.15	0.15	0.15
Calculated nutrient composition of the experimental diet (%DM)				
Crude protein	20.96	19.87	18.78	17.68
Crude fibre	4.21	4.16	4.12	4.08
Ether extract	4.23	4.5	4.75	5.01
Ash	3.25	3.11	2.97	2.82
Phosphorus	1.13	1.12	1.12	1.1
Calcium	1.59	1.58	1.57	1.56
Lysine	1.20	1.30	1.53	1.71
Methionine	0.46	0.49	0.52	0.55
ME (kcal/kg)	2841.14	2885.66	2930.19	2974.71

*Provided the following per kg of feed; vitamin A, 1000iu; vitamin D3, 1500iu; vitamin E, 51mg; vitamin K, 2mg; Riboflavin, 3mg; Pantothenic acid, 10mg; Nicotinic acid, 25mg; Choline, 350mg; Folic acid, 1mg; Mg, 56mg; Iodine, 1mg; Fe, 20mg; Zn, 50mg; Co, 1.25mg.

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Table 2: Proximate and phytochemical composition of toasted *Mucuna sloanei* meal

Components	**Amount (% DM basis)**
Crude protein	22.12
Crude fibre	5.59
Ether extract	8.72
Ash	3.15
NFE	50.27
Phytochemicals (mg/100g)	
Tannins	6.20
Sponins	1.0
Alkaloids	1.0
Flavonoids	9.0
Plytate	1.07
Phenol	1.03

Table 3: Performance of finisher broilers fed graded levels of TMSM.

	Dietary levels of TMSM (%)				
Parameters	**T_1(0%)**	**T_2(5.0%)**	**T_3(10.0%)**	**T_4(15.0%)**	**SEM**
Average initial body weight (g)	1025	1030	1020	1035	6.5
Average final body weight (g)	2255^{c}	2449^{a}	2200^{c}	1695^{d}	55.2
Average daily body weight gain (g)	35.14	40.54	33.71	18.86	9.5
Average daily feed intake (g)	125^{b}	147^{a}	149.6^{a}	153.9^{a}	7.28
Feed conversion ratio (gfeed/g gain)	3.56^{c}	3.63^{c}	4.44^{b}	8.16^{a}	0.23
Feed cost (₦/kg feed)	113.59	150.93	166.12	176.92	
Cost of production (₦/kg meat)	404.38	547.88	737.57	1443.67	

abcd means within the same row with different superscript are significantly different.

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Table 4: Haematological and Biochemical indices of broiler finishers

	Dietary levels of TMSM (%)				
Parameters	**T_1(0.0)**	**T_2(5.0)**	**T_3(10.0)**	**T_4(15.0)**	**SEM**
HB (g/dl)	13.1^{a}	12.7^{a}	12.7^{a}	11.9^{b}	0.16
PCV (%)	42.3^{a}	39.7^{ab}	40.7^{a}	37.7^{b}	0.89
WBC (10^{12}/l)	11.6	11.4	11.6	11.0	0.18
RBC ($\times10^{12}$/l)	12.8^{a}	12.7^{a}	12.8^{a}	11.7^{b}	0.19
MCV (Fl)	33.3	32.2	32.6	32.1	0.45
MCH (Pg)	10.1	10.2	10.0	10.2	0.09
MCHC (g/dL)	30.6	31.2	30.9	31.7	1.11
Neutrophilis (µl)	55.3	52	52	52	0.93
Eosinophilis (µl)	1.33	1.33	1.67	1.67	1.05
Monocytes (µl)	1.33	1.67	1.33	2.0	0.29
Lymphocytes (µl)	42	45	45	44.3	0.67
Basophilis (µl)	0	0	0	0	
Total protein (g/dL)	61.3^{a}	59.3^{a}	58.3^{b}	55.3^{c}	0.83
Globulin	40.0	37.3	37.7	34.0	1.77
Albumin	24.7	22.0	20.7	21.3	1.73
Cholesterol (mmol/L)	10.4^{a}	9.9^{b}	$9.7b^{c}$	9.67^{c}	0.12
Creatinine (mmol/L)	24.3^{a}	22.0^{ab}	22.7^{b}	20.7^{b}	0.71
Urea (mmol/L)	8.87^{a}	8.53^{b}	8.43^{bc}	8.37^{c}	0.08
Na+	41.0	41.3	40.0	39.0	0.67
K+	1.4^{a}	1.2^{a}	1.2^{a}	0.9^{b}	0.06
HCO_3	11.6	10.9	11.2	10.8	0.29
Cl^-	25.6^{a}	22.0^{b}	22.6^{b}	22.6^{b}	0.76
ALT	1.37	1.2	1.3	1.2	0.09
SGPT	7.2	7.1	7.1	7.1	0.07
SGOT	12.5^{a}	12.4^{a}	11.8^{b}	11.6^{b}	0.14

abc means within the same row with different superscript are significantly different.