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EVALUATION OF THE GROWTH PERFORMANCE, CARCASS CHARACTERISTICS AND BLOOD INDICES OF BROILER FINISHERS FED GRADED LEVELS OF FERMENTED *Mucuna sloanei* SEED MEAL

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ABSTRACT

An experiment was conducted to determine the effect of Fermented Mucuna Sloanei Meal (FMSM) on growth, carcass characteristics and blood indices of finisher broilers. Fermented Mucuna Sloanei seeds were processed into meal and analyzed for proximate and phytochemical compositions. The meal was then used to make four broiler finisher diets at 0, 5.0, 10.0, and 15.0% inclusion levels, respectively. Each diet was fed to a group of 30 finisher broilers at 5 weeks old for 28 days using completely randomized design. Each group was further subdivided into three replicates of 10 birds each. Average daily feed intake and average daily weight gain decreased significantly ($p < 0.05$) as the dietary levels of Fermented Mucuna Sloanei Meal increased. Feed conversion ratio increased significantly as the dietary levels of Fermented Mucuna Sloanei Meal increased. Cost of production was significantly increased ($p < 0.05$) as Fermented Mucuna Sloanei Meal increased. The dressed weight and breast weight were significantly decreased ($p < 0.05$) with dietary inclusion of Fermented Mucuna Sloanei Meal. The heart, the liver and gizzard were significantly increased ($p < 0.05$) as the inclusion of Fermented Mucuna Sloanei Meal increased. The haemoglobin, packed cell volume, mean cell volume, mean cell haemoglobin concentration, Erythrocyte sedimentation rate, white blood cell and the differentials (lymphocytes, monocytes, neutrophils, eosinophils and basophils) were not affected by treatments ($p > 0.05$). The urea concentration and the liver enzymes (alanine amino transaminase, serum glutamate oxaloacetate transaminase and serum glutamate pyruvate transaminase) were not affected by dietary treatment. Blood indices affected were red blood cell, total proteins and creatinine which decreased significantly ($p < 0.05$) as the dietary inclusion of Fermented Mucuna Sloanei Meal increased. Therefore, replacement of soya bean with Fermented Mucuna Sloanei Meal should not exceed 5% dietary level.

Key words: blood indices, carcass, fermented mucuna, growth

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 and groundnut cake 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) hikes the price, leading to high cost of production and hence of poultry products. Soya bean is an oil seed legume, high in protein (44-47 crude protein) and forms the major source of plant protein for non-ruminants mainly poultry, constituting 20-30% level of inclusion in poultry ration (Opara and Okorie, 2015). 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 into 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 the promising legumes that are rich in protein and may serve as an alternative to soya bean. The seeds are used in southeastern Nigeria as condiment and for soup thickening (Uzomah and Odusanya, 2011). Its seed yield is about 0.8-2.0 t/ha with crude protein of about 28% (Aduku, 1993; Ijeh *et al*., 2004). Uzomah and Odusanya (2011) reported 23.92 crude protein, 3.18 crude fibre, 6.57 ether extract, 1.95 ash and 55.19 carbohydrate for *Mucuna sloanei.* Igbabul *et al.* (2012) reported different values for the proximate composition when fermented for varying durations: 13.12, 15.31 and 32.82% crude protein respectively for 24, 48 and 72 h fermentation; crude fat was 6.0% (unfermented) and 6.5, 4.0 and 5.0% respectively for 24, 48 and 72 h fermentation; ash was 1.8% (unfermented) and 1.6, 0.8 and 1.0% respectively for 24, 48 and 72 h fermentation; while carbohydrate was 69.82% (unfermented) and 70.48, 72.29 and 51.59%, respectively for 24, 48 and 72 h fermentation.

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One of the major constraints to 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-dihydroxyphenylalanine, tannins, trypsin inhibitors etc. (Ukachukwu and Obioha, 1997; Akinmutimi and Okwu, 2006). There is need to process the seed in order to reduce the effect of these anti-nutrients. Fermentation is one of the traditional and most effective ways of detoxifying feed items before use. It is known to have added value to foods and has been reported to increase the soluble phenolic content of legumes, thereby enhancing its anti-oxidant activities (Oyarekua, 2011). Torres *et al.* (2006) reported a remarkable improvement in the nutritive value and quality of legume seeds through fermentation. Igbabul *et al*. (2012) also reported that fermentation increased the protein content, moisture and crude fibre content of the *Mucuna sloanei* flour.

This study therefore was aimed at investigating the effect of fermented *Mucuna sloanei* meal on the growth performance, carcass characteristics and blood indices of broiler finisher birds.

MATERIALS AND METHODS

Source and Processing of *Mucuna* Seeds

The *Mucuna* 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 72 h. Water was changed daily. After 72 h fermentation, the seeds were washed and sun dried for seven days. The fermented dried seeds were milled into a fine powdery *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 fermented *Mucuna sloanei* meal (FMSM) at 0, 5.0, 10.0 and 15.0% inclusion levels partly replacing soya bean in the control diet. The diets were designated as T_0, $T_{5.0}$, $T_{10.0}$ and $T_{15.0}$ respectively. The ingredient and calculated nutrient composition of the diets are shown in Table 1.

Experimental Birds and Design

One hundred and twenty (120) delight super strain 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 1 m × 1.5 m. Feed and water were provided *ad libitum*. The trial lasted for 28 days.

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

Ingredients	Treatments (Dietary levels)			
	T_1	T_2	T_3	T_4
Maize	58	58	58	58
Soya bean	15	10	5	0
Mucuna sloanei	0	5	10	15
Groundnut cake	9	9	9	9
Fish meal	2	2	2	2
Blood meal	2	2	2	2
P.K.C.	5.2	5.2	5.2	5.2
Bone meal	5	5	5	5
*Vitamin. premix	0.25	0.25	0.25	0.25
Common salt	0.30	0.30	0.30	0.30
L-Lysine	0.15	0.15	0.15	0.15
Methionine	0.10	0.10	0.10	0.10
Wheat offal	3	3	3	3
Calculated nutrient composition of the experimental diets (% dry matter)				
Crude protein	20.07	19.59	19.10	18.62
Crude fibre	3.91	3.31	3.63	3.45
Ether extract	4.34	4.37	4.42	4.45
Phosphorous	1.05	1.02	0.99	0.96
Calcium	3.26	3.26	2.24	2.23
Di-Methionine	0.36	0.33	0.30	0.27
L-Lysine	0.89	0.79	0.69	0.59
Metabolisable energy (kcal/kg)	2873.88	2921.90	2969.92	3017.94

With the full meaning of FMSM as fermented *Mucuna sloanei* meal, T_1-0%FMSM; T_2-5.0%FMSM; T_3-10.0%FMSM; T_4-15%FMSM. *Provided the following per kg of feed; vit A, 1000iu; vit D3, 1500iu; vit E 51 mg; vit K, 2 mg; Riboflavin, 3 mg; Pantothenic acid, 10 mg; Nicotinic acid, 25 mg; Choline, 350 mg; Folic acid, 1 mg; Mg, 56 mg; Iodine, 1 mg; Fe, 20 mg; Zn, 50 mg; Co, 1.25 mg

Data Collection and Analysis

The birds were weighed at the beginning of the experiment to obtain their initial body weights and then 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 as the average daily feed intake divided by average daily weight gain.

Carcass Evaluation

At the end of the four-week feeding trial, three birds were randomly selected from each treatment (one per replicate) and used for evaluation of the carcass and internal organ weights. The birds were starved of feed overnight and then slaughtered by severing the jugular vein with sharp knife after they have been weighed. The birds were defeathered and

eviscerated. The live weights and dressed weights were recorded. Also weights of internal organs (liver, kidney, heart and gizzard) and length of intestine were taken and recorded and expressed as percentage of live weight.

Haematology and Blood Biochemistry

At the end of the 28-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 cell haemoglobin concentration (MCHC), mean cell volume (MCV) and white blood cell, using standard methods (Monica, 1984). Blood biochemical indices analyzed included total protein, cholesterol, urea, creatinine, liver enzymes and the electrolytes sodium, potassium, carbonate and chloride (Monica, 1984).

Statistical Analysis

Data collected were subjected to analysis of variance as outlined by Snedecor and Cochran (1978) where analysis of variance indicated significant treatment effects; means were compared using Duncan's New Multiple Range Test (DNMRT) as outlined by Obi (1990).

RESULTS AND DISCUSSION

Proximate Composition

The proximate and phytochemical compositions of the fermented Mucuna sloanei meal are shown in Table 2. The crude protein content, ether extract and nitrogen free extract were very close to the values reported by Igbabul *et al.* (2012). The presence of anti-nutritional factors supports the report of Oke *et al.* (2002) and shows that fermentation did not completely eliminate the anti-nutrients.

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

Constituents	Amount Mg/100g (% DM)
Moisture	8.0
Crude protein	34.3
Ether extract	4.27
Nitrogen free extract	49.73
Crude fibre	1.7
Ash	2.0
ME (kcal/kg)	3380.38
Phytochemical composition	
Tannins	1.42
Alkaloids	1.4
Flavonoids	7.96
Cardiac glucosides	9.41
Phytate	0.73
Phenols	0.78
Saponins	1.0

Performance of Finisher Broilers

The performance of the experimental broiler finishers birds is shown in Table 3. Average daily body weight changes and average daily feed intake decreased significantly ($p < 0.05$) as the dietary levels of fermented *Mucuna sloanei* meal (FMSM) increased. Feed conversion ratio increased significantly ($p < 0.05$) as the dietary intake of FMSM increased. The significant depression in feed intake and body weight gain as the dietary level of FMSM increased could be attributed to the presence of anti-nutritional factors such as tannin and saponin. Saponin has been reported to possess some bitterness (Sodipo and Akiniyi, 2000; Okwu, 2004) and caused retardation of growth rate due to a reduction in feed intake in poultry, rats, rabbits and swine (Cheeke and Shull, 1985). In rabbit and rat, condensed tannin from the browse plant Robin's pseudoacacia caused reduced feed intake, reduced growth and coprophogy (Raharjo *et al*., 1990) and reduced protein digestibility (Horigone *et al*., 1988). Consequently, the values for the feed conversion ratio increased as intake of FMSM increased. The feed cost per kg weight gain also increased as the inclusion levels of FMSM increased. The fermented *Mucuna sloanei* meal even at 5% dietary levels showed poor performance relative to the control ($p < 0.05$) for average daily weight gain and more so feed cost per kg weight gain increased tremendously. This finding supports the report of Akinmutimi and Essien (2011) that dehulled *Mucuna sloanei* meal could not replace soya bean meal even at 5% dietary level of inclusion.

Carcass Characteristics

The carcass and internal organ weights are shown in Table 4. The dressed weight and breast weight decreased significantly as the dietary levels of FMSM increased. The decrease in the breast weight (% live weight) of the group fed FMSM was an indication that nutrients required for tissue synthesis were not sufficient. This could be attributed to poor utilization of protein due to the presence of anti-nutritional factors such as L-dihydroxyphenylalanine and tannin. Tannin is reported to form complexes with dietary proteins (Vaithiyanathan and Kumar, 1993) as well as endogenous proteins including enzymes and this may inhibit the actions of proteolitic enzyme from undergoing normal metabolism of proteins. Matthew *et al*. (2010) reported that higher percentage breast indicated better protein utilization by birds. The dressed percentage (69.69 to 73.51%) were within the range (60.30-74.65%) recommended for broiler chickens (Bangbose and Niba, 1998). The control gave best dressing percentage which was an indication that higher dietary energy gave higher percentage dressed weight (Igwuene, 2013). The heart was significantly increased ($p < 0.05$) at 15% dietary level. This could be attributed to the toxic effect of

the *Mucuna* seeds. 15% dietary level or more is capable of causing or stimulating cardiac hypertrophy. The weight of the liver increased significantly ($p < 0.05$) with the dietary inclusion of FMSM. The enlargement of these organs could be due to increased metabolic activities of the liver in trying to make up for reduced availability of proteins due to presence of anti-nutritional factors (Omeje, 1999; Marty and Chavez, 1993; Matthew *et al*., 2010). The findings support the report that liver is a major detoxification organ and hence increase in its activities may result in enlargement and probably increased weight (Akinmutimi, 2004; Akinmutimi, 2011).

Haematology and Blood Biochemistry

The results of the haematological and blood biochemical indices of FMSM are presented in Table 5. Apart from red blood cell that was significantly influenced ($p < 0.05$) by dietary treatments, all other haematological parameters measured were not significant ($p > 0.05$). There was no significant treatment ($p > 0.05$) effect in all the serum biochemical indices examined except the total proteins and creatinine which were significantly influenced ($p < 0.05$) by dietary treatments. Red blood cell decreased significantly ($p < 0.05$) at 15% dietary level of inclusion. Low values of red blood cell could be an indication of anaemia (Mohammed and Oloyede, 2009). Low value of red blood cell at 15% dietary level could be due to the toxins from the test material as a result of anti-nutrients. White blood cell that was statistically similar was a sign of absence of any specific infection from the feed. Total proteins decreased significantly ($p < 0.05$) with the dietary inclusion of FMSM. This could be attributed to the anti-nutrient – tannin that forms complexes with protein thereby making it unavailable. The globulin and albumin decreased significantly with the inclusion of FMSM. Globulins are carriers of certain metals through the blood stream to various parts of the body that helps to fight infection. Globulin often rises with heavy infections because of increased production of antibodies. The decrease in globulin level was an indication of absence of infection arising from the test feed. Low values of creatinine could mean that there was no muscle wastage (Ukpabi *et al*., 2015).

Table 3: Performance of the experimental broiler finisher birds

	Dietary level of FMSM				
Parameters	T0.0	T5.0	T10.0	T15.0	SEM
Average initial body weight (g)	860	850	850	870	10.2
Average final body weight (g)	2370^{a}	1900^{b}	1750^{c}	1470^{d}	23.3
Average daily weight gain (g)	68^{a}	48^{b}	39b^{c}	27^{c}	4.93
Average daily feed intake (g)	187^{a}	180^{b}	172^{c}	156^{d}	0.58
Feed conversion ratio	2.75^{c}	3.76^{bc}	4.36^{b}	5.78^{a}	0.37
Feed cost (N/kg)	94.86	110.92	143.5	167.82	
Feed cost per kg weight gain	260.82	417.06	625.75	970.12	

abcd means within the same row with different superscripts are significantly different ($P < 0.05$)

Table 4: Carcass and internal organ characteristics of the experimental finisher broiler birds

	Dietary level of FMSM (%)				
Parameters	T_1 (0%)	T_2 (5.0%)	T_3 (10.0%)	T_4 (15.0%)	SEM
Live weight (kg)	2.27^{a}	1.80^{b}	1.65^{b}	1.37^{c}	0.04
Dressed weight (% live weight)	73.51^{a}	72.20^{b}	71.53^{b}	71.00^{b}	0.50
Breast weight (% live weight)	20.34^{a}	17.35^{ab}	18.30^{ab}	16.59^{b}	1.16
Thigh/Drumstick (% live weight)	22.21	18.63	22.06	21.79	2.35
Wing (% live weight)	8.09	8.94	7.64	9.85	1.07
Neck (% live weight)	3.56	4.67	5.67	6.29	1.24
Head (%live weight)	3.20	3.43	3.68	4.02	0.48
Back (% live weight)	14.86^{a}	13.75^{b}	13.80^{b}	11.50^{c}	0.01
Heart (%live weight)	1.04^{b}	1.88^{ab}	1.53^{ab}	2.55^{a}	0.44
Liver weight (% live weight)	1.74^{c}	3.15^{a}	2.00^{bc}	3.42^{a}	0.39
Gizzard (% live weight)	2.28^{b}	3.54^{ab}	2.77^{ab}	3.91^{a}	0.50
Kidney (% live weight)	0.16	0.18	0.18	0.19	0.02
Intestinal length (cm)	182^{a}	177^{ab}	173^{ab}	156^{b}	8.29

Table 5: Serum biochemical indices of the experimental finisher broiler birds

	Dietary levels of fermented mucuna sloanei meal (%)				
Parameters	T_1 (0)	T_2 (5)	T_3 (10)	T_4 (15)	SEM
Haemoglobin (Hb) g/dl)	13.0	12.7	12.4	12.2	3.01
Packed cell volume (PCV) %)	42.7	40.6	40.0	38.7	1.32
Red blood cell (RBC) ($\times 10^{12}$/L)	12.9[a]	12.8[a]	12.3[a]	11.8[b]	0.29
Mean cell volume (MCV)(FL)	32.4	31.7	32.9	32.6	3.01
Mean cell haemoglobin concentration (g/dl)	30.4	31.6	30.9	31.6	0.54
Mean cell haemoglobin (pg)	10.1	10.0	10.2	10.2	0.10
Erythrocyte sedimentation rate ($mm^3/1^{st}$ 1 hr)	13.7	14.7	12.7	13.0	1.12
White blood cell count ($\times 10^9$/L)	11.5	11.4	11.3	11.1	0.23
Lymphocytes (%)	43.6	43.3	44.3	43.6	028
Neurophilis (%)	53.0	54.0	52.5	53.3	1.31
Eosinphils (%)	1.6	1.6	1.3	1.3	0.22
Monocytes (%)	1.6	1.4	1.2	1.3	0.30
Basophils (%)	0	0	0	0	0.00
Serum biochemical indices of the experimental finisher broiler birds					
Total proteins (g/dl)	6.5[a]	6.03[a]	5.93[b]	5.65[b]	0.13
Albulin (s/dl)	2.30[a]	2.13[b]	2.00[b]	2.06[b]	0.55
Globulin (s/dl)	4.02[a]	3.90[ab]	3.93[ab]	3.56[b]	1.18
Arsinine (s/dl)	1.20	1.40	1.20	1.93	0.21
Urea concentration (mmol/L)	9.0	8.63	8.60	8.0	1.92
Cholesterol (mmol/L)	10.4	10.07	9.87	9.53	0.26
Creatinine (mmol/L)	2.50[a]	2.33[b]	2.06[c]	2.10[c]	0.03
Sodium (mmol/L)	43.33	41.33	41.0	40.67	1.00
Potassium (mmol/L)	1.33	1.23	1.27	0.97	0.12
Carbonate (mmol/L)	11.2	11.1	10.7	10.8	0.22
Chloride (mm0ol/L)	25.0[a]	22.67[b]	22.67[b]	21.33[c]	1.38
ALT (iu/L)	1.36	1.23	1.30	1.26	0.05
SGOT (iu/L)	12.07	12.00	11.50	11.57	0.33
SGPT (iu/L)	7.43	7.23	6.87	6.90	0.13

CONCLUSION

The results of the trial have shown that fermented *Mucuna sloanei* meal could not serve as a good replacement to soya bean in broiler feed even at 5% dietary level because of poor weight gain, poor feed conversion ratio and high cost of feed per kg weight gain.

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