

EFFECT OF ENZYME (ZYMPEX 0.8) SUPPLEMENTATION ON PERFORMANCE AND BLOOD INDICES OF FINISHER BROILERS FED DIETS CONTAINING TOASTED *Mucuna sloanei* MEAL

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Abstract

An experiment was conducted to evaluate the effect of enzyme (zymplex 0.8) supplementation on performance, carcass characteristics and blood indices of finisher broilers fed diets containing enzyme supplemented toasted *Mucuna sloanei* meal. The enzyme supplemented toasted *Mucuna sloanei* meal was used to make broiler finisher diets at 0.0%, 5.0%, 10.0% and 15.0% inclusion levels, respectively. These were then used to raise groups of 30 broiler finishers in a completely randomized design (CRD) for 4 weeks (28 days). At the end of the 28 days feeding trial, 3 birds were selected from each group for blood indices and internal organ weight determination. The average daily weight gain, average daily feed intake and feed conversion ratio decreased significantly ($P < 0.05$) at 15.0% dietary levels. The T3 (10.0%) dietary level gave a feed conversion ratio that was comparable to the control but better than other enzyme supplemented toasted *Mucuna sloanei* meal groups. Feed cost increased with increase in dietary levels ($P < 0.05$). The liver (%) and heart (%) also decreased significantly ($P < 0.05$) with inclusion of enzyme supplemented toasted *Mucuna sloanei* meal. Haemoglobin, packed cell volume and white blood cell decreased significantly ($P < 0.05$) as the dietary levels of enzyme supplemented toasted *Mucuna sloanei* meal increased and especially at 15.0% dietary level. Serum proteins, urea and cholesterol decreased significantly ($P < 0.05$) with the inclusion of enzyme supplemented toasted *Mucuna sloanei* meal. It was therefore concluded that enzyme supplemented toasted *Mucuna sloanei* meal can serve as feed ingredient at 5 – 10% dietary levels.

Keywords: Blood indices, enzyme, finisher broilers, performance, toasted *Mucuna*

Introduction

The poultry industry in Nigeria will grow faster if cheaper and available feedstuffs rich in protein and carbohydrate to replace soya bean and maize could be identified and utilized in the industry. *Mucuna sloanei* has been identified as one of those promising legumes that could play a vital role in the development of the livestock and poultry industry in Nigeria especially because of its rich protein content. *Mucuna sloanei* has been reported to contain 23.92% crude protein, 3.18% crude fibre, 6.57% ether extract, 1.95% ash and 55.19% carbohydrate (Uzomah and Odusanya, 2011). Igbabul *et al.* (2012) reported 32.82% crude protein, 5.0% Crude fat,

1.0% ash and 51.59% carbohydrate when fermented for 72 hours. Akinmutimi, *et al.* (2011) reported the following values of 28.96% crude protein, 5.61% crude fat, 8.11% crude fibre, 4.55% ash, 28.55% nitrogen free extract and gross energy value of 3.94 kcal/g for toasted *Mucuna sloanei* meal.

Mucuna grains have been reported to possess anti nutritional factors such as L-dihydroxyphenylalanine, tannins and trypsin inhibitors. (Ukachukwu and Obioha, 1997; Akinmutimi and Okwu, 2006). 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-nutrients in seeds can be reduced by proper application of heat (Farris and Singh, 1990, Balogun *et al.*, 2001). However, Akinmutimi *et al.* (2011) reported that toasted *Mucuna sloanei* even at 5% dietary level did not give any positive growth performance. There is need therefore to employ the services of enzymes as feed additives to improve performance. Enzymes have been known to improve livability, feed conversion ratio and weight gain in broiler chickens. Enzymes have the potential to reduce the effect of anti-nutritional factors and make more nutrients available for growth and production. Zymplex 0.8 is a synthetic pharmaceutical enzyme product designed to improve the digestibility of monogastric animal diets. It is a multi-enzyme complex containing a range of carbohydrate, which hydrolyses a broad spectrum of carbohydrate polymers such as hemicelluloses, xylulases, pectinases, pentosanases, proteaseamylase and lipase carriers. These are targeted towards enhancing proper utilization of the feed, increase availability of protein, fat and carbohydrates and ensure efficient feed conversion ratio.

This study was therefore designed to evaluate the effect of enzyme supplementation on performance and blood indices of finisher broilers fed diets containing toasted *Mucuna sloanei* meal.

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 Local Government Area 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, washed and toasted for 10 - 15 minutes at 45°C until it becomes brownish in colour. The

toasted *Mucuna sloanei* seeds were milled in a hammer mill to obtain a fine powdery toasted *Mucuna sloanei* meal. The enzyme - Zympex 0.8 was incorporated into the toasted *Mucuna sloanei* meal at the rate of 100g to 100kg of feed. Samples of the *Mucuna sloanei* meal were taken to the laboratory for proximate and phytochemical analysis according to AOAC (2010). Before the incorporation of the enzymes, an enzyme potency test was carried out by dissolving the enzymes in 50 centilitre (CL) of water. This was poured into the cellulose in a container and allowed to stand for 12 hours in which the cellulose dissolved showing that the enzyme was active (positive).

Experimental diets

Four finisher broiler diets were compounded, incorporating the toasted *Mucuna sloanei seed* meal fortified with enzyme (Zympex 0.8) 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 T₀, 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) 4 - 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 28 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 gain and feed conversion ratio. Feed conversion ratio was calculated by dividing the average daily feed intake by average daily weight gain.

Carcass evaluation

At the end of the 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 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 and the internal organ (liver, kidney, heart and gizzard) and length of intestine were 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 three 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 ethylene diamine tetra acetic acid for haematological and blood biochemical indices, respectively. Blood was analyzed within three hours of collection for red blood cell, haemoglobin concentration, white blood cell, packed cell volume, mean cell haemoglobin, mean cell haemoglobin concentration, mean cell volume and differential white blood cell counts using standard methods (Monica, 1984). Blood biochemical indices analyzed included total protein, cholesterol, urea, creatinine, enzymes and the electrolytes-sodium, potassium, carbonate and chloride (Monica, 1984).

Table 1: Ingredient and calculated nutrient compositions of the experimental diets

Ingredients	Dietary levels of toasted <i>Mucuna sloanei</i>			
	T ₁ (0.0%)	T ₂ (5.0%)	T ₃ (10.0%)	T ₄ (15.0%)
Maize	55	55	55	55
Soya bean	15	10	5	0
<i>Mucuna sloanei</i>	0	5	10	15
Groundnut cake	10	10	10	10
Palm kernel cake	5	5	5	5
Wheat off	3	3	3	3
Fish meal	4	4	4	4
Brewer grain	3	3	3	3
Bone meal	4	4	4	4
*Vitamin premix	0.25	0.25	0.25	0.25
Common salt	0.25	0.25	0.25	0.25
L-Lysine	0.25	0.25	0.25	0.25
DL-Methionine	0.25	0.25	0.25	0.25
Calculated chemical compositions of experimental diets				
Crude protein	21.4	20.63	19.82	19.09
Crude fibre	4.86	5.0	5.42	5.303
Ether extract	4.27	4.09	3.92	3.74
Calcium	1.50	1.49	1.49	1.45
Phosphorus	1.30	1.30	1.30	1.30
Lysine	1.10	0.60	1.10	1.10
Methionie	0.60	0.60	0.60	0.60
Metabolizable Energy kcal/kg	2942.04	2812.04	2952.04	2957.04

*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.

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 Discussions

Proximate Composition

The proximate composition of the enzyme fortified toasted *Mucuna sloanei* meal revealed that it has 22.12% crude protein and a metabolizable energy of 3,310.46 kcal/kg. The crude protein content were similar to the values reported by Uzomah and Odusanya (2011). The high metabolizable energy and crude protein content affirmed the fact that toasted *Mucuna sloanei* supplemented with exogenous enzyme can serve as a good source of energy and protein. Toasted *Mucuna sloanei* supplemented with exogenous enzyme also contained some quantities of tannins (5.92%), saponin (3.52%), alkaloids (2.31%), flavonoids (13.41%), phytate (0.79%) and phenol (0.37%) which showed the presence of anti nutrients even after toasting.

Table 2 shows the performance of the broiler finishers fed varying levels of enzyme supplemented toasted *Mucuna sloanei* meal. The average final weight gain and average daily weight gain decreased significantly ($P < 0.05$) as the dietary level increased. Average daily feed intake was significantly decreased ($P < 0.05$) at 15.0% dietary level. It has been reported that birds placed on enzyme supplemented diets have decreased feed intake as a result of meeting their nutrient needs by taking less amount of feed (Oladunjoye and Ojebiyi, 2010). T₃ (10.0%) dietary level gave better feed conversion ratio that is comparable ($P > 0.05$) to the control. The overall improvement in feed utilization and gain in weight as seen in T₃ (10.0%) dietary level could be attributed to the ability of the enzymes to cause the breakdown of the fiber or non starch polysaccharides components (NSPS) of the diets by disruption of plant cells walls and thus enhancing proper absorption of nutrient (Akpodiete *et al.*, 2006; Ademola *et al.*, 2012). Feed cost per kg weight gain increased as the enzyme supplemented toasted *Mucuna sloanei* meal increased. This is attributed to the high cost of the *Mucuna sloanei*.

Table 2: Performance characteristics of broiler finisher birds fed varying levels of enzyme supplemented toasted *Mucuna sloanei* meal.

Parameters	Dietary levels of enzyme supplemented toasted <i>Mucunasloanei</i> meal				SEM
	T ₁ (0.0%)	T ₂ (5.0%)	T ₃ (10.0%)	T ₄ (15.0%)	
Initial weight (g)	1220	1216.67	1246.67	1208.00	11.16
Final weight (g)	3396.67	3163.33	3249.33	2900.00	57.50
Average daily weight gain (g)	77.74 ^a	69.52 ^a	72.23 ^{ab}	60.42 ^c	2.09
Average daily feed intake (g)	213.79 ^a	212.71 ^a	212.58 ^a	210.84 ^b	0.50
Feed conversion ratio	2.74 ^a	3.07 ^b	2.94 ^b	3.50 ^a	0.10
Feed cost/kg feed	112.69 ^d	142.02 ^b	154.00 ^c	164.70 ^a	5.95
Feed cost/kg gain	309.15 ^c	436.47 ^b	452.80 ^b	575.87 ^a	29.33

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

Table 3 shows the carcass and internal organ characteristics of the broilers fed enzyme supplemented toasted *Mucuna sloanei* meal. The percent dressed weight, breast muscle, thigh and drumstick were significantly decreased ($P < 0.05$) as the dietary levels increased. This finding contradicts the report of Rahman *et al.* (2005) who reported increase in carcass yield as a result of increase in carcass and breast muscle fat deposition for enzyme supplemented diet. The dressed percent (87.04 –

89.23) were higher than the values (60.30 – 74.65%) recommended for broiler chickens (Bangbose and Niba, 1998) and also higher than the values (71.96 – 80.78) and (72.04 – 75.37) reported by Abu *et al.*, (2011) and Mohammed *et al.* (2014), respectively, for enzymes supplemented diets. The breast muscle (%) (15.84 – 17.56) were higher than the values (12.21 – 15.00) reported by Abu *et al.* (2011) and lower than the values (31.39 – 33.28) reported by Mohammed *et al.* (2014).

Table 3: Carcass characteristics of broiler finisher birds fed varying levels of enzyme supplemented toasted *Mucunasloanei* meal.

Parameters	Dietary levels of enzyme supplemented toasted <i>Mucuna sloanei</i> meal				SEM
	T ₁ (0.0%)	T ₂ (5.0%)	T ₃ (10.0%)	T ₄ (15.0%)	
Live weight (kg)	3.866 ^a	3.533 ^b	3.630 ^{ab}	3.093 ^c	0.09
Dressed weight (%)	89.23 ^a	88.67 ^a	88.17 ^a	87.04 ^b	0.96
Carcass cut in (%)					
Breast muscle	17.56 ^a	15.84 ^b	15.86 ^b	16.34 ^b	0.30
Thigh	9.85 ^a	8.96 ^{ab}	9.29 ^{ab}	8.50 ^b	0.21
Drumstick	9.41 ^a	7.82 ^b	8.55 ^b	7.75 ^b	0.22
Back formation	15.34 ^a	11.05 ^b	12.73 ^{ab}	10.83 ^b	0.67
Neck	3.96	2.82	2.75	2.81	0.22
Wing	3.18	3.01	3.22	3.86	0.17
Shank	3.18	2.82	3.31	3.01	0.09
Head	3.59 ^a	1.22 ^b	3.22 ^a	3.79 ^a	0.36
Gizzard	2.42	1.97	2.20	2.41	0.10
Liver	2.42 ^a	1.79 ^b	1.92 ^b	1.61 ^b	0.12
Heart	1.23 ^a	0.66 ^b	0.60 ^b	0.64 ^b	0.03

abc means within the same row with different superscript are significantly different ($P < 0.05$)

The internal organs affected were the liver and the heart which decreased significantly ($P < 0.05$) with the inclusion of enzyme supplemented toasted *Mucuna sloanei* meal. This implies that there was no pathological damage done to the visceral organs as a result of anti-nutritional factors in the *Mucuna*. The enzymes may have contributed tremendously in reducing the negative effect of the anti-nutritional factors, thus enhancing feed utilization and normal organ development.

Table 4 shows the haematological and blood biochemical indices of broiler finishers fed enzyme supplemented toasted *Mucuna sloanei* meal. The results showed that the haemoglobin (HB), packed cell volume (PCV %) and white blood cell (WBC) were affected by treatments ($P < 0.05$). The

haemoglobin was significantly decreased at 15.0% dietary level compared to the control. Low values of haemoglobin and red blood cell was a good indicator of emerging anaemia. However, the values were within the normal ranges (11.60 – 13.68) reported by Wikivet (2013). The packed cell volume (%) ranged from 40.00 – 43.67. It decreased significantly at 15.0% dietary level compared to the control. A decrease in packed cell volume was an indication of liver and kidney diseases (Demoranvilles and Best, 2013). The values obtained from this study were higher than the values (21.25 – 30.45) reported by Aguihe *et al.* (2014) and within the normal range (35.9 – 41.0%) (Merck Veterinary Manual, 1979, Wikivet, 2013). The white blood cell decreased as the dietary levels increased. This was an indication

that there was no infection of the blood or any unwholesome poisoning of the blood by the enzyme supplemented toasted *Mucuna sloanei* meal.

The biochemical indices of enzyme supplemented toasted *Mucuna sloanei* meal showed that the total protein, urea and cholesterol were significantly affected by treatments. The protein value (58.00 – 65.00) decreased significantly at 15.0% dietary level. A decrease in serum protein concentration could be due to interference on normal protein metabolism (Bolu and Balogun, 2009). The values of serum protein obtained in this study were higher than the values (5.50 – 6.20) and (28.43 – 37.70) obtained by Ukpabi *et al.* (2015) and Odetola *et al.* (2015) respectively. The urea value (8.40 – 4.80) significantly decreased as the inclusion of enzyme supplemented toasted *Mucuna sloanei* meal increased. Urea is an indicator of the serum protein quality. The higher the urea the lower the protein quality and vice versa. The value showed that

enzyme supplemented toasted *Mucuna Sloanei* meal was of a higher protein quality compared to the control. The values obtained in this study were lower than the values (9.97 – 11.07 mg/dl) and (15.00 – 26.00 mg/dl) obtained by Odetola *et al.* (2015) and Ukpabi *et al.* (2015). The cholesterol values (9.80 – 10.63 mg/dl) were significantly influenced by dietary treatments. The enzyme supplemented diets were significantly decreased ($P < 0.05$) and especially at 15.0% dietary level. This could be a normocholesterolemic condition which could be attributed to the enzymic action of catalyzing the digestion and metabolization of lipids. The non significant effect of the enzyme supplemented diet on the enzymes serum glutamate oxaloacetate transaminase (SGOT) and serum glutamate pyruvate transaminase (SGPT) was an indication that no damage was done to the blood and internal organs as a result of the dietary treatments.

Table 4: Haematological indices of broiler finishers fed varying levels of enzyme supplemented toasted *Mucunasloanei* meal.

Parameters	Dietary levels of enzyme supplemented toasted <i>Mucunasloanei</i>				SEM
	T ₁ (0.0%)	T ₂ (5.0%)	T ₃ (10.0%)	T ₄ (15.0%)	
Hb g/dl	13.23 ^a	12.90 ^a	12.7 ^{ab}	12.36 ^b	0.11
PCV %	43.67 ^a	40.67 ^{ab}	41.00 ^{ab}	40.00 ^b	0.56
RBC ×10 ¹² /l	12.87	12.80	12.83	12.26	0.11
MCV fl	133.93 ^a	131.60 ^b	131.70 ^b	132.86 ^{ab}	0.34
MCH pg	20.47	20.07	19.87	20.33	0.10
MCHC %	30.27	31.57	30.70	30.93	0.26
ESR mm/h	18.33 ^b	26.67 ^a	26.67 ^a	3333 ^a	1.85
WBC ×10 ⁹ /l	12.00 ^a	11.63 ^b	11.27 ^c	11.43 ^b	0.08
WBC differentials %					
Neutrophils	52.33	54	53	52	0.57
Eosinophil	1.67	1.33	1.67	1.33	0.15
Basophil	-	-	-	-	-
Lymphocyte	44.00	43.67	44.00	44.67	0.46
Monocyte	2.00 ^a	1.00 ^a	1.33 ^b	2.00 ^a	0.14
Total serum protein g/dl	65.00 ^a	62.33 ^a	62.00 ^a	58.00 ^b	0.89
Albumin g/dl	21.33	20.67	20.67	20.67	0.29
Globulin g/dl	43.67 ^a	41.67 ^a	41.33 ^{ab}	37.33 ^b	0.87
Albumin/globulin ratio	1.2	1.2	2.3	3.5	0.47
Urea mg/dl	8.80 ^a	8.47 ^b	8.50 ^b	8.40 ^b	0.05
Creatinine mg/dl	24.67	23.00	23.67	22.00	0.48
Cholesterol mg/dl	10.63 ^a	10.20 ^{ab}	10.37 ^a	9.80 ^b	0.10
Na mmol/l	44.67 ^a	42.00 ^b	41.33 ^b	40.67 ^b	0.54
K mmol/l	1.43 ^a	1.20 ^b	1.37 ^a	1.13 ^b	0.04
HCO ₃ ⁻ mmol/l	12.57	11.27	11.07	11.27	0.36
Cl ⁻ mmol/l	25.00 ^a	22.67 ^b	24.00 ^{ab}	22.67 ^b	0.39
Alkaline phosphate μ/l	1.43	1.37	1.30	1.30	0.04
SGOT μ/l	11.83	11.60	11.73	1163	0.11
SGPT μ/l	7.17	7.17	6.93	7.07	0.05

abc means within the same row with different superscript are significantly different ($P < 0.05$)

Conclusion and Recommendation

It was concluded that:

1. Broilers on 5.0 and 10.0% inclusion levels compete favorably with birds on 0% dietary

level in terms of weight gain, feed intake and feed conversion ratio.

2. Feeding of enzyme supplemented toasted *Mucuna sloanei* meal did not induce any

- damage or dysfunction of any of the visceral organs.
3. The diet did not have any negative or deleterious effect on the blood indices of the broilers. The protein quality was seen to be good.
 4. It was therefore concluded that enzyme supplemented toasted *Mucuna sloanei* meal can be added in broiler finisher ration at 5 – 10% dietary levels.

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