

# Growth response and serum biochemical parameters of starter broiler chickens fed toasted African yam bean (*Sphenostylis stenocarpa*) seeds meal with enzyme supplementation

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## ADDITIONAL KEYWORDS

Toasted African yam bean seed meal.  
Enzyme supplementation.  
Performance.  
Serum biochemistry.

## SUMMARY

This study was conducted using one hundred and fifty one day old Marshal (R) strain of broilers to determine growth response and serum biochemistry parameters of toasted African yam bean seed meal (AYBSM) with enzyme supplementation. Five diets were formulated such that African yam bean seed meal replaced soybean meal at 0, 5, 10, 15 and 20% for diets 1, 2, 3, 4, and 5 respectively. Diets 2, 3, 4 and 5 were enzyme supplemented at the rate of 100 g/1000 Kg of the feed. The birds were randomly assigned to the five dietary treatment groups in a completely randomized design (CRD) experiment. Each treatment had thirty chickens which were replicated three times with ten chickens per replicate. The parameters measured were body weight, feed intake, feed conversion ratio, weight gain, mortality, total protein, albumin, globulin creatinine, cholesterol, aspartate amino transferase, alkaline phosphate and alanine aminotransferase. The experiment lasted for five weeks. Result revealed that test diets group performed better than control (0%) i.e., test diet ranged between 929.77 (g)-1216.51 (g) while control had 800.00 g. 20% AYBSM had least (2.03) feed conversion ratio (FCR) while control (0% AYBSM) gave highest (2.97 g) FCR. There were no significant differences ( $p>0.05$ ) in serum biochemistry analyzed except albumin and total protein that were significantly ( $p<0.05$ ) affected. The chickens fed on control had highest value of albumin level (2.07 g/dl) while chickens placed on 20% AYBSM gave least value of 1.67 g/dl, similar trend was observed for total protein. Toasted African yam bean seed meal with enzyme supplementation improved growth performance of at the broiler starter phase and had no negative effect on serum biochemistry measured. It is concluded that Toasted AYBSM can be used up to 20% in broiler starter diets.

## Respuesta de crecimiento y parámetros bioquímicos del suero en broilers de iniciación alimentados con harina de semillas tostadas de ñame africano y suplementación enzimática

## RESUMEN

Este estudio se llevó a cabo empleando 150 pollos broiler de un día de la cepa Marshal (R) para determinar la respuesta de crecimiento y los parámetros bioquímicos del suero, empleando harina de semillas tostadas de ñame africano (AYBSM) en sustitución de harina de semilla de soja al 0, 5, 10, 15 y 20% (dietas 1, 2, 3, 4 y 5). Las dietas 2, 3, 4, y 5 fueron suplementadas con enzimas en la proporción de 100 g/1000 Kg de pienso. Las aves fueron aleatoriamente asignadas a los cinco grupos dietéticos en un diseño experimental completamente aleatorizado. Cada tratamiento incluyó 30 aves con tres repeticiones de diez aves cada una. Las variables medidas fueron: peso corporal, ingestión de alimento, conversión alimenticia, ganancia de peso, mortalidad, proteína total, albúmina, globulina, creatinina, colesterol, aspartato amino transferasa, fosfatasa alcalina y aminotransferasa. El experimento tuvo una duración de cinco semanas. Los resultados ponen de manifiesto que los grupos sometidos a las dietas experimentales rindieron mejor que el control (0%). Así, las dietas probadas oscilaron entre 929,77 (g)-1216,51 (g) mientras el control alcanzó 800 g. Un 20 por cien de AYBSM tuvo una conversión alimenticia (FCR) menor (2,03) que el control (0% AYBSM) que fue de 2,97. No hubo diferencias significativas en la bioquímica del suero analizada, salvo para albúmina y proteína total que fueron afectadas significativamente ( $p<0,05$ ). Las aves del grupo control mostraron mayores valores para los niveles de albúmina (2,07 g/dl), mientras que las aves en el tratamiento 20% AYBSM presentaron los valores más bajos (1,67 g/dl), un modelo similar fue observado para la proteína. La AYBSM tostada con suplementación enzimática, mejoró el crecimiento en la fase de iniciación de los broilers y no presentó efectos negativos sobre los parámetros bioquímicos del suero medidos. Se concluye que la AYBSM tostada, puede ser empleado hasta el 20% en dietas de iniciación de broilers.

## PALABRAS CLAVE ADICIONALES

Harina tostada de semilla de ñame africano.  
Suplementación enzimática.  
Rendimientos.  
Bioquímica del suero.

## INFORMACIÓN

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## INTRODUCTION

Under-utilized legumes have tremendous potential for commercial exploitation but remain ignored (Bhag, 1992). They are important sources of dietary proteins for both human and animals, but the presence of relatively high concentration of toxins (trypsin inhibitors, phytic acid, saponin, oxalate e.t.c) affects the nutritional quality, inhibit a number of enzyme and bind nutrients making them unavailable (Nowacki, 1980). It's effects limit the use of raw African yam bean seeds in monogastric feed. Although various processing techniques tend to reduce the anti-nutritional factor content of the seed. African Yam bean (*Sphenostylis stenocarpa*) is one of the edible, underutilized grain legumes widely cultivated in Africa that is used in man and animal nutrition (Eke, 2002). African Yam bean seed is rich in protein (19.5%), carbohydrates (62.6%), fat (2.5%), vitamins and minerals (Iwuoha and Eke, 1996). The protein is made up of over 32% essential amino acids with lysine and leucine being predominant (Onyene-kwe *et al.*, 2000). Therefore, it helps to make use of this lesser-known and under-utilized legume in the feed preparations especially in the developing countries for animal consumption.

Research on the use of exogenous enzymes in broiler diets has been ongoing for decades. Most commercial enzyme products currently available have more than one enzyme activity whereas fewer products have only one substrate specificity. A wide range of endogenous proteases are synthesized and released in the gastrointestinal tract of the bird, and these are generally considered sufficient to optimize feed protein utilization (Nir *et al.*, 1993; Le Huerou-Luron *et al.*, 1993). However, based on protein digestibility values reported in the literature, it appears that valuable amounts of protein pass through the gastrointestinal tract without being completely digested (Lemme *et al.*, 2004). On the other hand, research done with products with only one protease activity allows for easier interpretation; however, literature on this type of study with chickens is scarce.

The use of blood examination as a way of assessing the health status of animals has been documented (Muhammed *et al.*, 2000; Owoyele *et al.*, 2003). This is because it plays a vital role in physiological, nutritional and pathological status of organisms (Muhammed *et al.*, 2000). They range from giving the level of the blood to detecting ailment or disorders through them. It had been reported that biochemical changes as a result of toxins have effects on haematological parameters (John 1998, Kamish 2003). The effect of differently processed underutilized legumes has been evaluated on the haematological parameters of broiler (Muhammed *et al.*, 2000; Owoyele *et al.*, 2003), but there is little or no information on effect of toasted and enzyme supplementation of AYBSM on growth respond and haematological parameters of broiler production. Therefore, this study directed toward investigating growth response and serum biochemistry parameters of broiler starter fed graded level of toasted African yam bean seed meal with enzyme supplementation.

## MATERIALS AND METHODS

### EXPERIMENTAL SITE

The experiment was carried out at the Poultry Unit, Teaching and Research Farm, Oyo State College of Agriculture and Technology, Igbo-ora, Nigeria. Latitude 7°15'N and longitude 3°30' E with average annual rainfall of 1278 mm and average temperature of 27°C.

### PROCUREMENT AND PROCESSING OF TEST INGREDIENT(S)

African yam bean seeds were procured at Bodija market, Ibadan North local government, Ibadan, Oyo State, Nigeria. The beans were sorted to remove extraneous materials such as stones, dirt and other seeds. The brown AYB seeds were toasted using frying pan measuring 74.5 cm x 38 cm place fire and allowed to stay between 3-5 minutes with stirring at regular intervals to ensure even distribution of heat until the beans were crispy, thereafter, crispy beans were mill by using hammer mill machine and product called African yam bean seed meal.

### CHEMICAL COMPOSITION OF TOASTED AFRICAN YAM BEAN SEEDS

AYB seeds were analyzed for nutritive values using AOAC (2010) while metabolizable energy (ME Kcal/Kg) was calculated by using Ponzenga equation (1985);  $ME = (37 \times \text{crude protein}) + (81.8 \times \text{crude fat}) + (35.5 \times \text{NFE})$  while NFE was obtained by differences;  $NFE = 100 - (CP - CF - FAT - ASH - MC)$ . MC- moisture content, CP- crude protein, CF- crude fibre. NFE= Nitrogen free extract.

### FEED FORMULATION

Five experimental diets were formulated by using maize as source of energy and soybean meal and toasted African yam bean seed meal (TAYBSM) were sources of plant protein. The crude protein content of the diets ranged from 22.58% diet 1 to 22.55% in diet-5 while the Metabolizable energy ranges from 3002.92 ME (Kcal/Kg) in diet-1 to 3077.97 ME (Kcal/Kg) in diet 5. All treatment contained toasted African yam bean seed meal with enzyme supplementation except control diet (D1/0%), i.e., diets (D2, D3, D4 and D5 contained 5%, 10%, 15%, and 20% as shown on **table I**. Protease enzyme was used as supplement and included at the rate of 100 g/ tone.

### EXPERIMENTAL BIRDS AND MANAGEMENT

A total of 150 day old Marshal® strain of broiler chicks purchased from a reputable hatchery were used for the experiment, Nigeria. The birds were divided into five treatment groups of 30 birds each. The treatments were replicated thrice at the rate of 10 birds per replicate in a Completely Randomized Design (CRD). Each replicate was housed in a floor pen (0.6 m by 0.3 m) with wood shavings as litter materials and equipped with feeders and drinkers. Experimental diets were supplied *ad-libitum*. Vaccination and medication schedule as applicable to the experimental location were strictly adhere to.

**Table I.** Composition of experimental diets (0-5 weeks) (Composición de las dietas experimentales) (0-5 semanas).

Ingredients (Kg)	(0%) TAYBSM	(5%) TAYBSM	(10%) TAYBSM	(15%) TAYBSM	(20%) TAYBSM
Maize	56.00	54.70	53.59	52.08	50.77
Soybean meal	40.00	38.00	36.00	34.00	32.00
TAYBSM	0.00	3.30	6.61	9.92	13.23
DCP	2.00	2.00	2.00	2.00	2.00
Limestone	1.00	1.00	1.00	1.00	1.00
Methionine	0.25	0.25	0.25	0.25	0.25
Premix (B) <sup>1</sup>	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00
Enzyme (g)	0.00	10.00	10.00	10.00	10.00
Calculated analysis					
ME (Kcal/Kg)	3001.92	3020.92	3046.81	3058.96	3077.97
C P (%)	22.58	22.08	21.59	21.07	20.55
C F (%)	3.51	3.48	3.45	3.40	3.35
E E (%)	3.64	3.70	3.75	3.80	3.86
Calcium (%)	1.20	1.21	1.21	1.22	1.21
Phosphorus (%)	0.61	0.62	0.63	0.62	0.63

TAYBSM= Toasted African yam bean seed meal; DCP= Di-calcium phosphate; ME= Metabolizable energy; CP= Crude protein; CF=Crude fibre; EE= Ether extract; Premix B (Broiler).

<sup>1</sup>A premix Kg contained: Vitamin A, 110 000 000 IU; Vitamin D, 2 500 000 IU; Vitamin E, 20 000 mg; Vitamin K<sub>3</sub>, 3 000 mg; Vitamin B<sub>3</sub>, 3 000 mg; Vitamin B<sub>2</sub>, 7 000 mg; Vitamin B<sub>6</sub>, 5000 mg; Vitamin B<sub>12</sub>, 25mg; pantothenic acids 10 000mg; Iron, 4 000mg; Folic acid, 8 000 mg; Biotin, 50mg; Manganese 80 000 mg; Zinc, 60 000 mg; Copper, 8 000 mg; Cobalt, 250 mg; Iodine, 1 000 mg; Selenium, 180 mg/150mg; Chlorine, 200 000 mg and Antioxidant, 100 000 mg.

#### DATA COLLECTION

Data on daily feed intakes were determined by subtracting the leftovers from the feed offered to the birds. The weight changes were calculated as the difference in the weight from the previous week. Feed conversion ratio was calculated as the ratio of the feed intake to the weight gain.

At 5 weeks of feeding trial, blood samples were collected from one bird per replicate between 8 to 10 am through puncture wing vein by means of sterilized disposable needle and syringe into bottles that free of any anticoagulant. It was centrifuged at 1000 r.p.m for 10 minutes and the serum was separated and analyzed. Serum protein, albumin and globulin were analyzed colorimetrically using diagnostic reagent kits (Renal Diagnostikal Reagents, Keszlet, Hungary) based on total protein (Wechelbaun, 1964) albumin and globulin

(Dumas and Briggs, 1972) and cholesterol (Roschian *et al.*, 1974) respectively. Activities of serum aspartate aminotransferase (AST), alanine aminotransferase (ALT), and alkaline phosphate (ALP) were determined colorimetrically (Reitman and Frankel, 1957).

#### STATISTICAL ANALYSIS

Data collected were subjected to analysis of variance (ANOVA) using (SPSS 2012) 21 version (IBM Corp, 2012). The means were separated by using Duncan multiple range test of the same software.

#### RESULTS AND DISCUSSION

The performance characteristics of the broiler starter is presented in **table II**. There were no significant ( $p>0.05$ ) difference in initial weight and mortality but significant differences ( $p<0.05$ ) were observed bet-

**Table II.** Performance characteristics of Starter broiler chickens (0-5 weeks) (Características de rendimiento productivo de pollos broiler de iniciación (0-5 semanas).

Parameters (g)	Diet 1 (0%)	Diet 2 (5%)	Diet 3 (10%)	Diet 4 (15%)	Diet 5 (20%)	SEM
Initial weight	40.23	40.23	40.23	40.23	40.23	40.23
Final weight	800.00 <sup>d</sup>	1243.33 <sup>a</sup>	1030.00 <sup>bc</sup>	970.00 <sup>c</sup>	1116.67 <sup>b</sup>	42.52
Weight gain	759.77 <sup>d</sup>	1216.51 <sup>a</sup>	989.77 <sup>bc</sup>	929.77 <sup>c</sup>	1076.44 <sup>c</sup>	42.22
FCR	2.97 <sup>a</sup>	2.09 <sup>b</sup>	2.24 <sup>b</sup>	2.35 <sup>b</sup>	2.03 <sup>b</sup>	0.10
Feed intake	2241.31 <sup>ab</sup>	2391.02 <sup>a</sup>	2198.32 <sup>ab</sup>	2156.60 <sup>b</sup>	2209.90 <sup>ab</sup>	33.08
Mortality	2.00	3.00	2.33	2.33	1.33	0.24

<sup>abcd</sup>=means within the same row with different superscript differ significantly ( $p<0.05$ ); FCR= Feed conversion ratio.

**Table III.** Serum indices of starter broiler chickens (0-5 weeks) (Índices séricos de pollos broiler de iniciación (0-5 semanas).

Parameters (%)	Diets 1 (0%)	Diets 2 (5%)	Diets 3 (10%)	Diets 4 (15%)	Diets (20%)	SEM
Albumin	2.07 <sup>a</sup>	1.77 <sup>b</sup>	1.73 <sup>b</sup>	1.83 <sup>b</sup>	1.67 <sup>b</sup>	0.05
Total protein	5.25 <sup>a</sup>	4.80 <sup>ab</sup>	4.07 <sup>ab</sup>	3.80 <sup>b</sup>	4.67 <sup>ab</sup>	0.21
Globulin	3.19	3.02	2.34	1.97	3.00	0.19
Creatinine	0.41	1.07	0.69	0.86	0.61	0.12
Cholesterol	209.11	148.24	130.44	129.61	198.76	1.27
ALT	2.51	2.45	1.81	2.51	0.70	0.30
ALP	511.57	515.33	477.90	504.35	521.13	6.74
AST	128.79	119.90	122.33	111.34	108.37	3.48

<sup>a,b,c,d</sup>=means within the same row with different superscript differ significantly ( $p < 0.05$ ).

ALT= Alanine aminotransferase; ALP= Alkaline phosphate; AST= Aspartate aminotransferase; SEM= Standard error of mean.

ween final weight, weight gain, feed intake and feed conversion ratio. The highest ( $p < 0.05$ ) final weight (1216.33 g) and weight gain (1216.51) was obtained in birds fed 5% African yam bean seed meal with enzyme supplementation while the lowest value of 800.77 g was recorded on bird fed control diet 1 (0% toasted African yam bean seed meal without enzyme supplementation). The lowest weight gain was obtained on the birds placed on control diet with the value of 759.77 g. The lowest weight gain noticed in birds placed on the control diet (0% AYBSME) compared with test diets suggested that soybean meal which is the only plant protein source in the control had lower amino acid profile than toasted African yam bean seed meal. African yam bean seed meal was reported to contain similar or better essential amino acid profile than soybean (Kine, 1991).

The higher feed conversion ratio (FCR) was obtained in the birds fed control diet (2.97) while lowest (2.03 g) was recorded in the birds placed on 20% toasted African yam bean seed meal with enzyme supplementation. Lowest value of 2.03 g recorded in the birds placed on Diet 5 could be as a result of low fibre content in the diet 5 (table I) thus leading to better conversion of the diet to flesh as revealed by the FCR while highest FCR of 2.97g obtained from control birds could be attributed to the higher fibre content in the control diet as well as effects of the anti-nutritional factors on reduction of protein metabolism and absorption and utilization of minerals. D'Mello (1991) reports that trypsin inhibitor adversely influenced the utilization of protein in rats by increasing the amount of cysteine and methionine requirement. Udedibie and Carlini (1998) are of the views that even minute amounts of residual haemagglutinin in processed jack bean could constitute a problem to birds on *ad-libitum* feeding system and anti-nutritional factor is resistant to proteolytic digestion and therefore tends to accumulate in the animals by binding to the intestinal wall, thereby reducing the efficiency of feed utilization.

The result of the serum biochemistry of broilers starter is presented in table III. There were no significant differences ( $p > 0.05$ ) among serum biochemistry analyzed (globulin, creatinine, cholesterol, aspartate aminotransferase, alkaline phosphate, alanine aminotransferase except albumin and total protein that

were significantly ( $p < 0.05$ ) affected. Birds fed on control diet had highest value of albumin level (2.07 g/dl) while birds placed on 20% inclusion of toasted African yam bean seed meal with enzyme supplementation had lowest value (1.67 g/dl). The total protein revealed that birds fed on control diets had highest value of 5.25 g/dl and lowest value of 3.80g/dl was recorded on birds placed on 15% inclusion level of toasted African yam bean seed meal with enzyme supplementation. The result of this study is in agreement with Lawrence *et al.*, (2012) who opine that albumin and total protein were different when growing rabbit were fed with cocoa bean shell supplemented with enzyme. However, the result obtained in this study for all the dietary treatments fall within the normal range for broiler as reported by Mitruka and Rawsley (1977).

## CONCLUSION

It was observed that toasted African yam bean seed meal with enzyme supplementation resulted in a synergistic improvement in the performance of the broilers at the starter phase. This study also confirmed that toasting and enzyme supplementation of African yam bean seed meal gave no deleterious effect on serum biochemistry of broiler starter.

## RECOMMENDATION

Base on the outcome of this finding, 20% inclusion level of toasted African yam bean seed meal with enzyme supplementation can be used to feed broiler starter without adverse effect on performance and serum biochemistry. Higher levels of inclusion of toasted African yam bean seed meal with enzyme supplementation should be investigated in broiler starter diet.

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