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Effect of addition of multi-enzyme and varying levels of toasted African yam bean seed meal on carcass characteristics and internal organs of broiler starter

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Abstract

African yam bean seed is one of the underutilized legumes and a prospective feed ingredient in poultry diet. This study was carried out to examine carcass characteristics and internal organs of broiler starter fed partial replacement of toasted African yam bean seed meal supplemented with multi-enzyme (TAYBSM+E). There were five treatments: treatment one (T1) served as control without TAYBSM+E while T2, T3, T4 and T5 contained 20%, 40%, 60% and 80% TAYBSM+E, respectively and supplied experimental broiler birds for four weeks. Each treatment was randomly assigned to one of the five experimental diets in a completely randomized designed. Two hundred birds were allotted to five treatments replicated four times with 10 birds per replicate. At four weeks of age, experimental birds were starved for 12 hours; one bird was sacrificed per replicate (four per treatments), de-feathered and cut into different parts. Carcass cuts and vital organs were carefully collected and weighed with sensitive scale. All parameters in the carcass cuts and internal organs weight examined were not statistically (P>0.05) influenced except intestine, lungs and thigh that significantly (P<0.05) different. It is concluded that toasted African yam bean seed meal supplemented with multi-enzyme is a good source of protein that can be used in broiler feeds safely up to 80% inclusion level to give satisfactory results.

Keywords: Broiler starter, Toasted African yam bean seed, carcass, organs weight and multi-enzyme

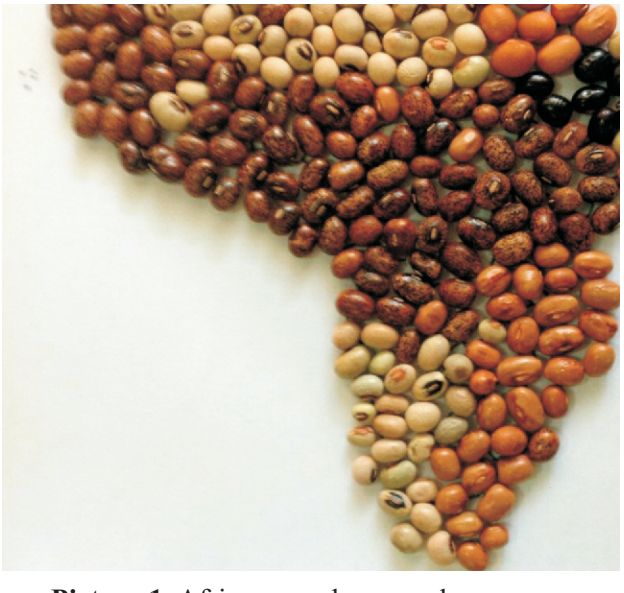
Introduction

The protein requirements of the chickens in their diets are met mostly by both vegetable and animal proteins. The feed ingredients of animal origin are commonly used in poultry diets and are considered as excellent quality of protein sources (Robinson *et al.,* 2001). Despite the satisfactory level of quality proteins, diets formulations with the feedstuff have been restricted from being used extensively for the manufacturing of poultry and other monogastric animals (CEC, 2000). Likewise, using animal products containing animal tissues has become an important issue due to concern over the spread of transmissible disease like salmonellosis (CEC, 2000). In the same vein, feed formulators also facing increased stress of using animal proteins in poultry diets because of higher cost involvement and consumer concern over the outbreak of diseases (bovine spongiform encephalopath, salmonellosis etc), as well as contamination of food products with zonotic agents.

African yam bean seed (AYBS) is an herbaceous leguminous plant occurring throughout tropical Africa as shown in figure 1. It is grown as minor crop in association with yam and cassava. AYB serves as security crop; it has the potential to meet year round protein requirements if grown on a large scale (World Health

Organization (WHO), 2002). AYB is highly nutritious with high protein, mineral and fibre content. Its protein content is reported to be similar to that of some major and commonly consumed legumes. Its amino acid profile is comparable or better than those of cowpea, soybean and pigeon pea (Obizoba and Souzey, 1989; Ene-Obong and Carnovale, 1992; Uguru and Madukaife, 2001). It is one of the edible, underutilized grain legumes that are used in man and animal nutrition (Eke, 2002). The protein is made up of over 32% essential amino acids with lysine and leucine being predominant (Onyenekwe *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.

Enzyme in poultry is one of the major nutritional advances in the last fifty years. The benefits of using enzymes as feeding additives in poultry diets include not only enhanced bird performance, digestibility and utilization of nutrients, but also less environmental, anti-nutritional factors and ecological problems (Georgieva *et al.,* 2010). A serious achievement in the field of the feeding enzymes is developing of multi-enzymes preparations, containing combination of different enzymes, considered with the component contents of compound feeds. In this connection, the enzymes, recommended about diets with participation of legumes seed, take a peculiar interest as plant protein components in the broilers' diets. There is a potential problem in the utilization of legumes in the diets, especially for young birds, which is connected with the content of anti-nutritional factors. The effect of differently processed underutilized legumes has been evaluated on the broiler but there is little or no information on effect of toasted and multi-enzyme supplementation of AYBSM on carcass characteristics and internal organs weight on broiler production. Therefore, this study directed toward investigating effect of addition of multi enzyme with varying levels of toasted African yam bean seed meal on carcass characteristics and internal organs weight of broiler starter.



Picture 1: African yam bean seed

Materials and methods

Experimental site

The experiment was carried out at the Poultry Unit, Teaching and Research Farm,College of Agriculture and Technology, Igbo-ora, Oyo State, Nigeria. The experimental site is in savannah forest zone of Latitude 7.43°N and longitude 3.8°E, with an elevation 140 m above sea level. The average minimum temperature is about 21.50°C and maximum temperature of 32.50°C. The average humidity in the area is 58.00%. The double maximum rainfall is about 214.3 mm in June and 165.2 mm in September.

Procurement, sorting and processing of African yam bean (AYB) seeds and other ingredients

African yam bean seeds were procured at Bodija market, Ibadan north Local Government Area, Ibadan, Oyo State, Nigeria. The beans were sorted to remove extraneous materials such as stones, dirt and other seeds. The AYB seeds were processed (toasted) using frying pan measuring 74.5cm x 38cm placed on fire wood and allowed to stay between 3-5 minutes with stirring at regular intervals to ensure evenly distribution of beans until the beans were crispy, thereafter, crispy beans were milled by using hammer mill machine and product called toasted African yam bean seed mill. While other ingredients like maize, soybean meal, methionine, lysine, di-calcium phosphate, limestone were obtained from reputable feedmill, Ibadan, Oyo State, Nigeria.

Chemical composition of toasted African yam bean seeds

The AYB seed meal were analyzed for nutritive values using AOAC (2010) while metabolizable energy (ME Kcal/Kg) was calculated by using MC Donald equation (1995) as shown;

ME= (37xcrude protein) + (81.8x crude fat) + (35.5xNFE) while NFE was obtained by differences; NFE= 100-(CP- CF – FAT-ASH - MC).

MC= moisture content, CP= crude protein, CF= crude fiber. NFE= Nitrogen free extract.

Procurement of enzyme

Multi-enzymes used for the experiment was purchased from a reputable feedmill in Oyo town. Manufacturer instruction was strictly followed, i.e. it was used at the rate of 400g/1000kg of feed (one tone of feed).

Composition of multi-enzymes used

Xylanase, Phytase, Cellulase, B-gluycose, Pectinas,a-Amylase, Protease, a-galactosidase, Lipase B-Galactosidase, Lipase and Mannanase.

Experimental diet formulation

Five experimental diets were formulated with partial substitution (nutrient to nutrient replacement) of soybean meal with toasted African yam bean seed meal. Percentage crude protein was ranged between 18.34%-21.75% while metabolized energy ranged between 3005.40 and 3253.02 Kcal/kg. Maize was the major source of energy while soybean meal and toasted African yam bean seeds meal were sources of protein. All treatments contained toasted African yam bean seed meal with multi-enzyme supplementation except control (T1), i.e. All treatments were designated as T1,T2, T3, T4 and T5 contained 0%, 20%, 40%, 60%, and 80% as shown on Table 1

Table 1: Gross Composition of the Experimental Diets (0-4 weeks)

Ingredients (kg)	T1 (0%)	T2 (20%)	T3 (40%)	T4 (60%)	T5 (80%)
Maize	60.00	51.48	42.97	34.45	25.93
Soybean meal	35.00	28.00	21.00	14.00	7.00
African yam bean	0.00	13.52	31.03	46.55	62.07
Bone meal	2.00	2.00	2.00	2.00	2.00
Limestone	2.00	2.00	2.00	2.00	2.00
Methionine	0.25	0.25	0.25	0.25	0.25
Premix (B)	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)	00.00	40.00	40.00	40.00	40.00
Calculated analysis					
ME (Kcal/kg)	3005.40	3067.31	3129.31	3191.12	3253.02
Crude Protein (%)	21.75	20.09	20.05	19.20	18.34
Fat (%)	3.63	4.39	5.15	5.92	6.64
Fibre (%)	1.87	1.54	1.73	2.43	3.64
Calcium (%)	1.24	1.37	1.29	1.32	1.34
Phosphorous (%)	0.53	0.57	0.61	0.64	0.68
Ash (%)	0.78	1.09	1.93	1.70	2.01

ME- Metabolizable Energy

Experimental birds, design and management

A total of 200 day old broiler chicks (Marshal R) were obtained from Obasanjo farm, Nigeria, Ltd. Igboora branch, Ibarapa Central Local Government, Oyo State, Nigeria. The brooder house was cleaned, washed, disinfected and fumigated two weeks before the arrival of the chicks. Drinkers, feeders and other equipment were also well cleaned and washed before the arrival of the birds. On the arrival of the day old broilers, they were gently unboxed into the brooding house that had previously been heated few hours to the arrival of the birds. The 200 birds were randomly allotted to five dietary treatments and replicated four times with 10 birds per replicate in a completely randomized design.

Vaccination and medication

On the arrival of the birds, they were placed on frucemide, glucose and vitalyte, which is combination of antibiotics and vitamins for 7 days by oral administration via water. Vaccinations were administered as scheduled.

Data collection

Carcass characteristics

At the end of the feeding trial (28days), four birds from each treatment (one per replicate) totalling 20 birds were starved for 12 hours, prior to slaughtering, birds were weighed in gram individually by used sensitive scale. Then, the slaughtered birds scalded in hot water at temperature of 53°C for two minutes and de-feathered by hand picking. Head and shanks were removed close to the scull at the occipital joint and at the hock joints, respectively. Evisceration was done by posterior ventral cut and then a complete removal and weighing of the visceral organs. Abdominal fat including fat surrounding the gizzard and liver was carefully removed and weighed. The dressed carcass, breast, thighs, and drum stick were weighed with bone. The wings were removed by a cut through the shoulder joint at the proximal end of humorous. The

thigh and drumstick portions were obtained by cutting through the joint between the femur and ilium bone of the pelvic girdle. The drum stick was separated from the thigh by a cut through the joint formed by the femur, fibula and tibia.

Internal organ weight

Internal organs such as the crop, proventriculus, gizzard, spleen, heart, liver, kidney, pancreas, and lungs were separated and weighed using a sensitive scale.

Data analysis

Data were analysed using SPSS version 21 (2012) software. Descriptive and one way ANOVA techniques using Duncan multiple range test and the means were separated by using software package of the same package.

Results

Carcass characteristics of the experimental broiler starters are presented in the Table 2. There were not statistically differences ($p>0.05$) in all parameters measured across the treatments except thigh. Thigh of the birds in treatment 3 (TI) were significantly ($p<0.05$) heavier (105.00g), slightly follow by birds in T2 (99.05g) that are statistically similar with T1 and T2 but were statistically ($p<0.05$) higher than 86.50g recorded in T5. Birds fed on control diets (T1) had least ($p>0.05$) of 857.50g live weight while birds fed on T3 had highest ($p>0.05$) of 980.50g. Dress weight, head weight, wing weight, shank weight, drumstick weight, breast weight and back weight followed the same trend with live weight.

Table 2: Carcass characteristics of the experimental birds (0-4 weeks)

Organs (g)	T1 (0%)	T2 (20%)	T3 (40%)	T4 (60%)	T5 (80%)	SEM
Live weight	857.50	910.50	980.50	877.50	879.99	19.91
Dress weight	803.00	841.00	861.00	828.50	817.50	16.20
Head	36.00	32.50	36.50	33.00	33.50	0.82
Neck	42.00	41.00	49.00	41.00	38.50	1.16
Wing	75.00	75.00	82.00	79.50	68.50	2.26
Shank	45.50	43.00	48.00	43.50	42.50	1.05
Drumstick	86.50	91.50	101.50	82.00	84.00	3.31
Breast	170.50	183.00	186.00	167.00	163.00	4.74
Back	87.00	110.50	111.50	89.50	99.50	4.27
Thigh	90.50^{ab}	99.50^{ab}	105.00^{a}	92.00^{ab}	86.50^{b}	2.56

T1= Control (0%); T2= 20% TAYB+E ; T3= 40% TAYB+E; T4= 60% TAYB+E; T5= 80% TAYB+E

Internal organs weights of the experimental birds are presented in Table 3. There were no statistical differences ($p<0.05$) among parameters measured across the treatments except lungs that were significantly different ($p<0.05$) in birds on T3 with value of 8.50g while T4, T5 and T1 were statistically similar with least value of 5.00g on T1 and highest value of 6.50g on T4. Non-significant ($p>0.05$) of 25.00g was obtained in T3 and 20.00g in T1, 2 and 3 Liver. Heart recorded higher ($p>0.05$) 7.50g in T2 and lower ($p>0.05$g) 5.00g in T4 and T5. Spleen gave ($p>0.05$) 0.05g in T5 while T1, T1, T3 and T4 gave 0.00g. Kidney showed ($p>0.05$) of 9.00g in T3 while T1 and T2 showed 4.50g. Whole gizzard gave ($p>0.05$) of 44.50g in T5 and 33.50g in T1. Proventriculus revealed ($P>0.05$) of 8.00g in T4 and 6.00g in T2. Length of intestine showed 70.00g in T5 and 53.50g in T1.

Table 3: Internal organs characteristics of the experimental birds (0-4 week)

Parameters (g)	T1 (0%)	T2 (20%)	T3 (40%)	T4 (60%)	T5 (80%)	SEM
Liver	20.00	21.00	25.00	20.00	24.00	1.20
Heart	6.00	7.50	6.00	5.00	5.00	0.46
Bile	2.50	1.50	1.50	1.00	0.50	0.31
Kidney	4.50	4.50	9.00	6.00	6.00	0.68
Empty Gizzard	22.50	26.00	29.00	23.00	27.50	1.35
Whole Gizzard	33.50	38.00	40.00	38.50	44.50	1.69
Proventriculous	6.50	6.00	7.50	8.00	7.00	0.30
Lungs	5.00^{ab}	2.50^{b}	8.50^{a}	6.50^{ab}	6.00^{ab}	0.78
Intestine length (cm)	53.50	58.50	60.00	60.00	70.00	2.40

T1= Control (0%); T2= 20% TAYB+E ; T3= 40% TAYB+E; T4= 60% TAYB+E; T5= 80% TAYB+E

Discussion

Weights of carcass cuts were fluctuating and similar except that of the thigh which may be implied that the utilization of protein from TAYBSM with multi-enzyme supplementation did not suppress physiological growth of birds. Tuleun *et al.* (2001) made similar observation in broiler birds fed processed (fermented) *mucuna* seed meal and suggested that processing method eliminated toxic compounds, which in turn removed depression observed when raw *mucuna* seed meal were fed to broilers.

Internal organs weight values were apparently not influenced by the inclusion of toasted African yam bean seed meal with multi-enzyme supplementation. This indicates positive effect of TAYBSM with multi-enzyme supplementation on internal organs weight of the experimental birds. An enlarged liver is often concerned when a diet high in anti-nutritional constituents are fed to broiler birds. In this experimental birds; liver weight was not different and showed a range between 20.00g to 25.00g and was lower than 57.1 to 97.0g reported by Idahor (2012) but heart weight was similar to 6.0 to 6.8g while the gizzard weight was slightly more than 33.5 to 36.5g reported by Idahor (2012). This observation is in line with the report of Tuleun, *et al.,* (2011) for broilers fed processed mucuna seed meal with reduced anti-nutritional factors. Ismail, *et al.,* (2008) and Soetan and Oyewale (2009) observed that internal organ enlargement, particularly, liver and pancreas, become inflamed in reaction to the release of trypsin inhibitors in legumes. This suggests that anti nutritional factors in TAYBSM were eliminated or reduced to minimum level that experimental broiler birds could tolerated and did not cause depressed anatomical and physiological conditions of broiler birds.

Conclusion

This study showed that toasted African yam bean seed meal with multi-enzyme supplementation based diets compared favourably with soybean meal and improved carcass characteristics of broiler starter. Among tested diets, 40% toasted African yam bean seed meal with multi-enzyme supplementation revealed best result. Therefore, toasted African yam bean seed meal with supplementation of multi-enzyme should be encouraged in the broiler diets.

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