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Potentials of toasted African yam bean seed meal supplemented with multi-enzyme on performance characteristics and blood serum of broiler starter chickens

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Target audience: *Feed producers, Policy makers and Livestock producers*

Abstract

A feeding trial was conducted for 4 weeks to evaluate the potentials of toasted African yam bean seed meal (TAYBSM) on performance characteristics and blood serum of broiler starter chicken with multi enzymes supplementation. Enzyme was supplemented at the rate of 400g/1000kg of feed (0.40g/1.00kg) except control (T1). TAYBSM was used to replace soybean meal at 0, 20, 40, 60 and 80% inclusion levels. Two hundred (200) day-old Marshal® broiler chicks were randomly allotted to five dietary treatments (T1, T2, T3, T4, and T5) of 40 birds each, replicated four times with 10 birds per replicate in a Completely Randomized Design. Data were collected on daily feed intake and weight gain. Blood samples were collected from two birds per replicate into plain sample bottles by using needle and syringe and transferred to the laboratory for assay. The outcome of the study revealed no significant differences (P>0.05) in the blood serum while performance characteristics showed significant differences (P<0.05). Toasted African yam bean seed meal with multi enzyme supplementation should be encouraged to replace soybean meal in broiler diets up to 80% inclusion level without any adverse effect on performance characteristics and blood serum.

Keywords: *Serum, Broiler, African yam bean seed, performance, toasting.*

Description of Problem

The broiler is a table bird or meat type bird that is generally acceptable to majority of Nigerians. Its production is easily managed in relation to other livestock enterprise (1, 2, 3). Under good management, broiler chickens attain live weight of about 2 kg in about 7 weeks (1). The main limitation to expansion of poultry industry is the availability of adequate supplies of needed feed ingredients at reasonable prices (4) and (5). Feed account for about 70% of total cost of production (6). The high cost of feed is mainly due to the increasing competition between man and livestock for grains and conventional sources of plant (soybean, groundnut seed) and animal proteins (7) and (8). The most promising way to solve the problem of competition between man and animal for plant protein is to identify cheaper and easily available feed stuff that are of low human preference and little or no industrial use that can meet nutritional requirements of poultry with or without processing (9), (10) and (11). One of such proteins (legume seeds) that has potential of being used in poultry feed is African yam bean (*Sphenostylis stenocarpa*).

African yam bean (AYB) is one of the lesser-known legumes that are now coming into prominence in nutritional and agronomic

research as an emerging food legume. It grows widely in the forest region of Nigeria but not fully exploited. Despite its enormous nutritional potential, it represents one of such under-utilized crops in Nigeria, Ghana and many tropical African countries (12),(13) and (14). Food security and sustainability are currently of serious global concern and unfortunately, many indigenous African crops that show promise in providing nutritional securities are presently neglected and under-utilized (15). In Nigeria, AYB is cultivated mainly in the southern and middle belt regions. African yam bean is used as food or food components and provides two consumable products: The tuber which grows as the root source and the actual yam beans which develop in pods above ground (1). Like other grain legumes, African yam bean is an excellent food, low in fat and rich in protein, carbohydrate, fibre, minerals and vitamins with relatively high contents of anti-nutrients (14). The effect of differently processed underutilized legumes has been evaluated on the hematological parameters of broiler (16) and (17), but there is little or no information on effect of toasted and enzyme supplementation of African yam bean on performance characteristics and blood serum of broiler chickens. Therefore, this study is directed towards investigating growth response and blood serum of broiler starters fed graded levels of toasted African yam bean seed meal with multi-enzyme supplementation.

Materials and methods

Experimental site

The experiment was carried out at the Poultry Unit, Teaching and Research Farm of Oyo State College of Agriculture and Technology Igbo-ora, Oyo State, Nigeria. The experimental site is in a savannah forest zone of Latitude 7.43^{o}Nand Longitude 3.8^{o}E, with an elevation of 140m above sea level. The average minimum temperature is about 21-50^{o}C?/ and maximum temperature of 32.50^{o}C. The average humidity in the area is 58%. The double maximum rainfall is about 214.3mm in June and 165.2mm in September (18).

Procurement of African yam bean seeds

The brown variety of African yam bean seed used for the study was purchased from Bodija market, Ibadan North Local Government area of Oyo State Nigeria. Other materials (ingredients) like maize, soybean, methionine, lysine, broiler premix, di-calcium phosphate, limestone and industrial salt (NaCl) were procured from Adom feed mill,Orogun area, Ibadan, Oyo State, Nigeria.

Sorting, processing of the African yam bean seeds and enzyme procurement

The beans were sorted by removing foreign materials like: stone, dirt and unwanted seeds apart from African yam bean seed (Brown variety). Seeds were toasted by using frying pan at the length of 74.5cm and breadth 38cm and placed on firewood between 3-5minutes and beans were stirred at regular interval to ensure even distribution of heat and beans were crispy to touch. Processed African yam bean seeds and other ingredients were milled using hammer mill withscreen size of 3mmseparately before mixing into different treatments at the feed mill unit of Training and Research Farm, Oyo State College of Agriculture and Technology, Igbo-ora.Multi-enzyme used for the study was purchased from a reputable farm in Oyo town. It was supplemented as prescribed by producer i. e at the rate of 400g/tonne (1000kg) of feed.

Composition of multi-enzymes used

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

Chemical composition of toasted African yam bean seeds

AYB seeds meal were analyzed forcrude protein, crude fibre, Ether extract, ash, dry matter by (19) while metabolizable energy (ME Kcal/kg) was calculated (20) as shown ME= (37×crude protein) + (81.8×crude fat) + (35.5×NFE). Nitrogen Free Extract(NFE)was obtained by difference.

Experimental diets

Five different diets were formulated by using maize as source of energy while soybean meal and toasted African yam bean seeds meal (TAYBSM) were sources of plant protein.All treatment contained toasted African yam bean seed meal with enzyme supplementation except control (Treatments T1) that contained no TAYBSM while T2, T3, T4 and T5 contained 20%, 40%, 60%, and 80% TAYBSM respectively to replaced soybean meal while multi-enzyme was used as feed additive as shown in Table 1.

Table 1: Gross composition of 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	100.0	100.0	100.0	100.0	100.0
Enzyme (g)	0.00	40.0	40.0	40.0	40.0
Calculated analysis					
ME (kcal/kg)	3005.4	3067.3	3129.3	3191.1	3253.2
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
Phosphorus (%)	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 chicks (Marshal ®) were obtained from a reputable hatchery in Lanlate, Oyo state, Nigeria. The birds were randomly allotted to five (5) dietary treatments and replicated four (4) times with 10 birds per replicate in a Complete Randomized Design (CRD).On arrival of the birds, they were placed on frucemide, glucose and vitalyte, which is combination of antibiotics and vitamins for 5 days by oral administration via water. Vaccinations were administered as scheduled.

Data collection

The initial weights of birds were recorded immediately at the beginning of the study. The birds were subsequently weighed on weekly basis to determine the weekly weight gains while records of mortality were kept throughout the four weeks of the experimental period. Feed conversion ratio **(**FCR) was also determined by calculated as the ratio of daily feed consumed to daily weight gain while feed intake was determined by subtracting left over feed from feed supplied.

Blood sample collection

At 3 weeks of feeding, blood samples were randomly collected from each replicate between 8-10 am through punctured wing-vein by means of sterilized disposable needle and syringe to aspirate 3mls of blood into plain sample bottles to allow clotting of the blood and transferred to the laboratory for assay and were determined by the methods described by (21). Parameters assayed were: Total protein (g/dl), albumin (g/dl), globulin (g/dl), albumin globulin ratio (AGR), creatinine and cholesterol (mg/dl).

Statistical analysis

Data collected were subjected to one way analysis of variance (22). 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 and discussion

Performance characteristics

Table 2 showed performance characteristics of broiler starters fed experimental diets. There were significant ($P<0.05$) differences in all the parameters measured. Final body weight ranged between 809.25(g) to 951.00(g). Total weight gain followed the same trend with final weight and ranged between 771.25(g) to 913.00(g).Feed intake ranged between 1120.00(g) to 1359.25(g), birds placed on T4 had higher (1359.25g) significant ($P<0.05$) feed intake and compared favourably with T3 while T2 had least (1120.00g) significant ($P<0.05$) effect. Feed conversion ratio (FCR) ranged between 1.35 to 1.78, T2, T3, T4 and T1 were significantly lower ($P<0.05$) than T5 (1.78g). T1, T2, T3 and T4 compared favourably with one another while birds fed on T5 gave poorest FCR. Birds on T1, T2, T3 and T4 converted feed to muscle than birds placed on T5, the lower the feed conversion ratio the superior the diets (23), this was linked with the presence of enzymes (pepsin) which has the ability to break down proteins, liberating it for use by the animal tissue. Better quality performance of birds placed on tested dietary treatments (T2 to T4) for final body weight and weight gain in accord with the report of (24) who opined that enzymes supplementation significantly ($P<0.05$) improved weight gain. The use of enzymes in poultry feeds has predominantly been related to the hydrolysis of fibre or non-starch polysaccharide (NSP) fractions in grains (24). These NSPs cannot be digested by the endogenous enzymes of poultry and can have anti-nutritional effects (24).

Table 2. Performance characteristics of broiler starter fed experimental diets

Parameters (g)	T1 (0%)	T2 (20%)	T3 (40%)	T4 (60%)	T5 (80%)	SEM
Initial weight	38.00	38.00	38.00	38.00	38.00	0.06
Final weight	835.25^{b}	866.50^{ab}	951.00^{a}	858.50^{ab}	809.25^{b}	16.63
Weight gain	797.25^{b}	828.50^{ab}	913.00^{a}	820.50^{ab}	771.25^{b}	16.63
Feed intake	1202.25^{ab}	1120.0^{0c}	1285.00^{ab}	1184.75^{bc}	1359.25^{a}	23.81
FCR	1.51^{a}	1.35^{b}	1.41^{b}	1.45^{b}	1.761.78^{a}	0.04

^{a,b,c,d,e} values in same row with different superscripts are significantly different (P<0.05)
SEM= Standard error of mean FCR= Feed conversion ratio

Table 3. Blood serum of broiler starter fed experimental diets (0-4 weeks)

Parameters	T1 (0%)	T2 (20%)	T3 (40%)	T4 (60%)	T5 (80%)	SEM
Total Protein (g/dl)	6.25	5.60	6.45	6.00	5.55	0.21
Albumin (g/dl)	2.15	1.50	2.40	2.15	1.55	0.23
Globulin (g/dl)	4.10	4.10	4.05	3.85	4.00	0.04
A/G Ratio	0.45	0.30	0.55	0.50	0.35	0.06
Glucose (g/dl)	303.5	392.5	306.5	406.0	375.5	21.2
Creatinine (mg/dl)	0.50	0.55	0.60	0.50	0.55	0.02

^{a,b,c,d,e} values in same row with different superscripts are significantly different (P<0.05)
SEM=Standard error of mean A/G Ration= Albumin Globulin Ratio

Blood serum

Table 3 showed blood serum of broiler starter fed experimental diets. There were no significant (P>0.05) differences among total protein, albumin, globulin, glucose and creatinine values. (analyzed as shown in the Table 3). Serum chemistry is consistently used to detect organ diseases in domestic animals and the amount of available protein in the diets (25). The range of total protein observed in this study (5.55 – 6.45g/dl) is in agreement with the range (5.87 – 6.55g/dl) reported by (14) when experimental feed were fed to the tested animals. (26)reported that serum protein concentration at any given time is a function of hormonal balance, nutritional status, water balance and other factors affecting health. The normal value observed in the total protein of these experimental birds fed toasted African yam bean seed meal with multi-enzyme supplementation could be attributed to positive effect of toasting/ heat treatment and multi-enzyme supplementation on anti-nutritional factors i.e elimination of anti-nutritional factors which could have prevented the proper utilization of the protein in the diets, resulting in improved performance of broiler. This study revealed that tested diet (Toasted African yam bean seeds meal with multi-enzyme supplementation) had adequate protein content that could supply normal protein required by broiler starter).

Conclusion and Applications

1. It can be concluded that 80% inclusion level of toasted African bean seed meal with multi-enzyme supplementation could potentially be used in feeding broiler starter since it compares favourably with control and did not affect health status of the broiler starter.

2. Toasted African yam bean meal with multi-enzyme supplementation should be encouraged in feeding broiler birds.

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