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QUANTITATIVE REPLACEMENT OF SOYBEAN MEAL WITH TOASTED AFRICAN YAM BEAN (*SPHENOSTYLIS STENOCARPA*) MEAL IN BROILER STARTER DIETS

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ABSTRACT

Eighty-four Anak broilers were used to study the effect of quantitative replacement of toasted soybean meal (TSBM) with toasted African yam bean (TAYB) meal in broiler starter diet. The experimental design was completely randomized design (CRD). There were four treatments each replicated three times with seven broilers per replicate. The inclusion levels of toasted African yam bean meal in diets were 0, 25, 50 and 75% in treatments I, II, III, and IV respectively. The parameters measured were final live weight, feed intake, feed conversion ratio (FCR) and cost/kg feed. Results showed that the starter broilers fed treatment IV diet had significantly (P<0.05) lower final live weight (592g) than those fed treatments III (631.66g), II (656g) and I (670g) diets. Daily weight gain followed the same trend as in final live weight. The feed intake of treatments IV (1241.66g) and III (1235.00g) diets were significantly (P<0.05) higher than those of treatments I (1222.66g) and II (1225.33g) diets. Starter broilers fed treatment IV diet had significantly (P<0.05) higher feed conversion ratio (2.10) than those fed treatment III having (1.95) which was also significantly (P<0.05) higher than those of treatments II (1.87) and I (1.28). Finally, parameters evaluated showed no significant different (P>0.05) between starter broilers fed treatment I and treatment II. From the result, one can conclude that 25% AYB (treatment II) compared favourably with the control diets 0% AYB in starter broiler diets and is hereby recommended as optimal for quantitative replacement of soybean in broiler starter diet.

Key words: Broiler Starter diet, African Yam Bean, Soyabean replacement
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INTRODUCTION

The major constraint on increased animal protein supply in Nigeria has remained the exorbitant and ever-increasing cost of commercial poultry feeds arising mainly from the high cost of feedstuffs and ingredients, especially the conventional ones like cereal grains (maize,

sorghum, wheat and millet), oil seed cakes (groundnut cake and soybean meal) and fish meal (Apata and Ojo, 2000). Therefore, to reduce the feed cost, which accounts for 60 to 70% of total cost (Nworgu *et al*., 1999) research efforts are being geared towards evaluating alternative feed ingredients for poultry (Ojewola *et al*., 2003, Bamgbose *et al.*, 2004; Onu and Okongwu, 2006; Ukachukwu, 2008; Iorgyer *et al.,* 2009; Amaefule *et al.*, 2011)). But according to Atteh and Ologbenla (1993) such alternative protein sources should have comparable nutrient value but cheaper than the conventional protein sources. They should also be available in large quantities. One of such alternative is African yam bean (*Sphenostylis stenocarpa*).

African yam bean (*Sphenostylis stenocarpa*) is one of the lesser-known legumes; it is becoming prominent in nutritional and agronomic research as an emerging food legume (Aletor and Aladetimi, 1989). Its yield ranges from 1860kg to 2000kg per ha (Evans and Boulter, 1974). Like other grain legumes lectins and others have been reported (Aletor and Aladetimi, 1989). The need for detoxification before use becomes imperative.

The objective of this study includes, determining the performance of starter broilers fed Toasted African yam bean and the optimal replacement of soybean meal with toasted African yam bean meal.

MATERIAL AND METHODS

Experimental Site

The research was carried out at the Teaching and Research Poultry Unit of College of Animal Science and Animal Production, Michael Okpara University of Agriculture, Umudike, Abia State. Umudike is located on Latitude $5^0$29´ North and Longitude $7^0$33´ East in the rainforest zone of Nigeria. The climate of the region is characterized by a daily temperature range of 24^0C and 36^0C throughout the year and an average rainfall of 2000mm per annum. The relative humidity is in the range of 51 – 86% during dry and rainy season respectively (NRCRI Metrological Centre Umudike, 2013).

Procurement and Processing of African Yam Bean and Other Feed Stuffs

Africa yam bean (AYB) was purchased from Umuahia main market in Abia State of Nigeria. Toasting was done as is done in garri production by turning small quantity of the AYB on a pan seated on fire for fifteen (15) minutes until it turned brown, milled and then incorporated into the diet. The rest of the feed ingredients and experimental birds were purchased from Umuahia and Aba, both in Abia State.

Management of the Experimental Birds

Eighty-four day-old Anak broilers were used for the experiment, which were randomly allocated into four treatment and three replicates groups and brooded in different partitions in completely randomized design. There were twenty one birds in each treatment and seven birds per replicated. The birds were weighed at the beginning of the experiment and thereafter on weekly basis with Camry brand 10kg weighing balance. Feed intake data were obtained as the difference between the quantities of food offered minus quantity left over (un-consumed). Feed conversion ratio (FCR) was calculated as feed intake divided by weight gain. Final live weight minus initial live weight gave live weight gain. Cost per kg diets was determined as the total cost per unit ingredients used. Vaccination and medication were administered throughout the experiment as need be. Feed and water were provided *ad libitum* for the four (4) weeks duration of the experiment.

Experimental Procedure

Four treatment diets were formulated for this experiment. They were assigned as treatment I, II, III and IV respectively. Treatment I (0% AYB) is the soybean based diet while Treatment II (25% AYB), III (50% AYB) and IV (75% AYB) had quantitative replacement of soybean (Table 1).

Experimental Design and Statistical Analysis

The starter broilers were randomly assigned to four treatments diets in a completed randomized Design (CRD). Each treatment groups was further subdivided into three replicates comprising seven birds each. The collected data were subjected to analysis of variance (ANOVA) as described by Steel and Torrie (1980), while means were separated using Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Table 3 shows the growth performance of starter broiler birds fed diet containing different level of toasted African yam bean. There were significant ($P<0.05$) differences in all parameters measured apart from the initial body weight. Final body weight and daily weight gain (g) followed the same pattern. Birds fed the control diet (0%AYB) and diet containing 25% toasted African yam bean were significantly different from diets III (50%) and IV (75%). Also diet III (50%) significantly differed from diet IV (75%).

Final body weight (g) and daily weight gain (g) followed a pattern; there was a gradual decline in value from control diet having the highest value to diet IV (75%) with the lowest value. The high final body weight (g) and daily weight gain (g) in the control and diet

containing 25% toasted African yam bean (TAYB) diets suggest a better feed utilization. Heating has been reported to be effective in reducing haemagglutinin and trypsin inhibitor content of AYB (Emiola, 2004), The lower performance of birds fed diet containing 50 and 75% AYB could be attributed to the effect of residual anti-nutritional factors such as trypsin-inhibitor, tannin and phytate (Table 2). Trypsin inhibit digestive enzymes by irreversibly binding themselves to the enzymes thus, making the enzymes unavailable for the breaking down of protein (Linear, 1980), leading to poor protein digestibility with the resultant effect of growth depression (Maynard *et al*, 1979). For total feed intake (g) the control diet and (25%) toasted African yam bean were significantly lower than diets III (50%) and IV (75%). Also for daily feed intake (g), diets I (0%) and II (25%) toasted yam bean were significantly lower than diets III (50%) and IV (75%).

The feed intake increased as quantity of test ingredient increase in the diets. This may be due to lower values of metabolizable energy of the diet containing the test ingredients, or could be that the birds increased feed intake to meet their energy requirements (Emenalom and Udedibie, 1998; Akinmutimi, 2004). Increase in the consumption of toasted yam bean diets could be an attempt of the broilers to meet nutrient requirements from a diet that contained some antinutritional substances as has been observed with broilers (Amaefule and Onwudike, 2000; Amaefule and Obioha, 2003; Onu and Okongwu, 2006).

The feed conversion ratio for diet I (0% AYB) and II (25% AYB) were significantly lower than diet III (50% AYB) and IV (75% AYB). The significantly ($P<0.05$) high values of diet III (50%) and IV (75%) when compared to diet I (0%) and II (25%) show poor nutrient utilization despite the high feed intake. The higher the feed conversion ratio, the poorer the diet (Ogbonna *et al.,* 2000) hence diet I and II was a superior diets followed by diet III.

Decreasing feed production cost (₦/kg) (72.81, 67.73, 62.63 and 55.53 naira) was observed as inclusion level of toasted African yam bean (TAYB) meal increased from 0 to 75% (Table 3).

CONCLUSION AND RECOMMENDATION

The results of this study have shown that dietary toasted African yam bean meal increased feed intake of starter broilers up to 75% dietary inclusion level. It reduced body weight after 25% dietary inclusion level. It appears therefore that starter broilers should not be fed toasted African yam bean **(***Sphenostylis stenocarpa*) meal above 25% level. There is need for an investigation into other ways of processing African yam bean **(***Sphenostylis stenocarpa*) so as to achieve a relatively higher level of dietary inclusion.

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APPENDIX

Table 1: Composition of Experimental Diets

Ingredient	0%(AYB)	25%(AYB)	50%(AYB)	75%(AYB)
Maize	52.44	52.44	52.44	52.44
Soybean	23.11	17.33	11.55	5.78
African Yam bean	0.00	5.78	11.56	17.33
Fish meal	7.70	7.70	7.70	7.70
Bone meal	0.50	0.50	0.50	0.50
Wheat Offal	15.00	15.00	15.00	15.00
Salt	0.50	0.50	0.50	0.50
Premix*	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Calculated values				
CP%	23.35	21.84	20.34	18.85
ME(Kcal/g)	2925.47	2919.66	2913.91	2908.14

***** Composition per kg diet: vitamin A 15,000 I.U, vitamin D3 13,000 I.U, vitamin E 30 I.U, vitamin K 2 2.5mg, Thiamine 2mg, Riboflavin; B2 6mg, pyridorine 4mg, Niacin 40mg, Cobalamin 0.05g, panthothenic Acid 910mg, Folic acid 1.0mg, Biotin 0.08mg, choline chloride 0.05g, manganese 0.096g, zinc 0.06g, Iron 0.024g, copper 0.006g, iodine 0.014g, selenium 0.24mg, cobalt 0.024mg, Antioxidant 0.125g.

Table 2: Anti-nutritional factors composition of test ingredient

Parameters	African Yam Bean Flour (AYB)
Tannin g/100 g	0.02
Trypsin-inhibitor g/100 g	1.12
Phytate g/100 g	2.39

Table 3: The effect of quantitative replacement of soybean meal with toasted African yam bean (TAYB) meal on the growth performance of broiler starter (0 – 4weeks)

Parameters	T (I)	T (II)	T (III)	T (IV)	SEM
Initial body weight (g)	45.00	45.33	45.66	45.33	0.14
Final body weight (g)	715.00[a]	701.33[a]	675.33[b]	637.00[c]	102.57
Daily weight gain (g)	23.91[a]	23.44[a]	22.56[b]	21.14[c]	0.11
Total feed intake (g)	1222.66[b]	1225.33[b]	1235.00[a]	1241.66[a]	11.70
Daily feed intake (g)	43.76[b]	43.76[b]	44.11[a]	44.34[a]	0.015
Feed conversion ratio	1.82[c]	1.87[c]	1.95[b]	2.10[a]	0.001
Cost/kg (₦)	72.81	67.73	62.63	55.53	-

Different superscripts on means within a row indicate significant difference (P<0.05)