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Growth performance of broilers fed varying levels of soaked false yam (*Icacina oliviformis*) tuber meal

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ABSTRACT

False yam (Icacina oliviformis) contains an anti-nutritional factor called resin or terpene and soaking the tuber in water may reduce the concentration of this factor and improve its nutritional value. The objective of this study was to determine the effects feeding three levels (0, 120 and150 g/kg) of the soaked false yam tuber on the growth performance of broilers. The tubers were peeled, chopped into smaller pieces, soaked in water (i.e. 1 part to 1.5 parts of water) for 15 d with continual changing of the water being every 3 d. After soaking, the chopped pieces were sun-dried (~85% DM) before being milled into gritty meal. The soaked false yam tuber meal (SFYTM) replaced maize (w/w) in a maize-fishmeal-based grower mash (210 g/kg CP and 12.6 MJ/kg ME) at 0, 120 and 150 g/kg. A total of 90 chicks (21 d; 348 g) were divided into 9 groups of 10 chicks (6 males, 4 females) per replicate and assigned to the treatments in a Completely Randomized Design. Data were analysed by ANOVA using GenStat. Incorporation of SFYTM at 120 and 150 g/kg as substitute for maize resulted in significant ($P<0.05$) reductions in mean feed intake, live weight gain, gain/feed ratio and carcass yield of the broilers. These results suggest that feed including SFYTM at ≥120 g/kg had adverse effects on the growth performance of broilers.

Keywords: *False yam (Icacina oliviformis) tuber, soaking, nutritive value, broilers*

INTRODUCTION

False yam [*Icacina oliviformis* (Poiret) J. Raynal synonym *I. senegalensis* A. Juss] is a newly identified non-conventional energy source for feeding animals. It is a common drought resistant shrub found in the Savanna regions of West and Central Africa. False yam is high yielding (Fay, 1993) and produces both tubers and seeds. Both products have potential for use in poultry diets as partial substitute for maize when processed either by soaking or boiling in water (Dei *et al*., 2011, 2013). Processing ameliorates adverse effects of toxic compounds referred to as resins (terpenes) in these products. Preliminary study involving the tuber meal has shown that the soaked material can be fed up to 90 g/kg as partial replacement for maize in broiler chicken diet without any adverse effects on growth performance (Dei *et al*., 2013). This finding appears encouraging since maize is a major cost item in poultry diet due to stiff competition between humans and livestock for

this commodity. Therefore, there is a need for further evaluation of the nutritional value of soaked false yam tuber meal when incorporated at moderate dietary levels for poultry.

This study was undertaken to determine effects of soaked false yam tuber meal on growth performance broiler chickens fed at 0, 120 and 150 g/kg.

MATERIALS AND METHODS

Preparation of soaked false yam tuber meal sample

The freshly harvested tubers were peeled, chopped into smaller pieces (~2 cm), soaked in water (i.e. 1 part to 1.5 parts of water) for 15 days with the water being changed every 3 days. The chopped product was then sun-dried for 4 days (i.e. ~85% DM of product) and milled into gritty meal labelled SFYTM.

Chemical analyses

The chemical analyses of the ground SFYTM sample in a previous study (Dei *et al*., 2011, unpublished data) for proximate, starch and essential amino acid compositions (Table 1) were conducted at the University of Missouri Experiment Station Chemical Laboratories, Columbia, USA using standard methods of AOAC International (2000). The sample was not analysed for its contents of anti-nutritional factors due to logistical problem.

Experimental birds

One hundred and twenty day-old 'Cobb 500' broiler chicks obtained from a hatchery in Kumasi were brooded in a deep-litter house for 21 d and fed broiler starter mash (230 g/kg CP, 12.6 MJ/kg ME). At 21 d of age, 90 chicks of similar live weights were randomly selected and divided into 9 groups of 10 chicks (6 males, 4 females) with mean initial live weight of 348 g per bird per group in a pen. The SFYTM was substituted (w/w) for maize at 0, 120 and 150 g/kg in a grower diet (Table 2). A group of 10 chicks was the experimental unit and each was randomly assigned to one of the 3 treatments with each treatment replicated three times in a Completely Randomized Design. The diets containing SFYTM were not balanced for dietary energy due to logistical problems of determining its metabolizable energy content. The birds were housed in raised-floor pens (1.8 m x 0.9 m = 0.16 m^2/bird) in an open-sided house. Feed and water were given *ad libitum* from 21 to 56 d of age. Light was provided 24 h.

Growth and carcass parameters measured

Feed intake per replicate was measured weekly by subtracting the left-over feed at the end of the week from the amount of feed provided. The daily feed intake per bird was calculated by dividing the amount of feed consumed by the number of birds and number of days in a week. Live weights of birds in each replicate were measured weekly by weighing them in batches of 3-5 birds using a digital electronic scale (Jadever, JPS-1050), and daily live weight gains calculated. Feed conversion efficiency was estimated as live weight gain per unit feed consumed in a day. No mortality occurred in this study. At 56 d of age, two birds (1 male, 1 female) were randomly selected from each replicate. They were starved for 8 h, slaughtered using recommended procedure (FAO, 1992) at the Meat Processing Unit of the University for Development Studies in Tamale, defeathered, eviscerated and the carcass yield measured as a per cent of carcass dress weight of live weight.

Statistical analysis

The dietary treatment effects for all the variables measured were analysed by ANOVA using GenStat 8th edition (Lawes Agricultural Trust, 2005).

RESULTS AND DISCUSSION

The nutrient composition of false yam tuber meal (Table 1) was typical of root and tuber crops such as cassava. The starch content of 581.2 g/kg ('as fed' basis) in the tuber was quite appreciable. False yam tuber is known to be high in carbohydrates (Fay, 1991). The high starch content was indicative of high energy. As expected, its gross energy content of 14.3 MJ/kg ('as fed' basis) was similar to that of maize.

The recorded crude protein and amino acid profile of the false yam tuber meal as shown in Table 1 were relatively far lower than those

reported in maize (Larbier and Leclercq, 1994) it is intended to replace in poultry diets. Therefore, one of its major nutritional concerns for poultry is its low protein and amino acid concentrations. Mohammed and Dei (2013) reported that addition of the false yam tuber meal to layer chicken diets significantly reduced dietary protein digestibility due to its poor essential amino acid contents.

The residual content of anti-nutritional factors (e.g. resins), though not determined in this study, may limit utilisation of the false yam tuber meal. Terpenes, reported as constituents of Icacina resin (Vanhaelen *et al*., 1986), can have negative impact on animals through toxic and deterrent effects (Gershenzon and Dudareva, 2007).

Table 3 shows the performance of birds fed the false yam tuber meal. Mean daily feed intake declined ($P<0.01$) when the birds were fed the soaked tuber meal at 120 and 150 g/kg. As a result of poor feed intake, their mean daily live weight gains were depressed ($P<0.001$). It appears a high residual concentration of Icacina resin may have been responsible for the poor performance of birds fed the soaked tuber meal; since Icacina resin is known reduce feed intake of animals (Gershenzon and Dudareva, 2007). In the previous study in which the soaked tuber meal was fed up to 90 g/kg in the diet, there was no adverse effects on broiler growth performance (Dei *et al*., 2013). This suggests toxic concentrations of the resin might have exceeded tolerable threshold when fed at moderate ≥120 g/kg level. Therefore, more work needs to be done in terms of processing in order to further improve the nutritional value of false yam tuber meal for broilers.

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Table 1: Composition of soaked false yam tuber meal (Dei *et al*., 2011, unpublished data)

Chemical component	Amount (g/kg "as fed" basis)
Proximate	
Dry matter	827.9
Crude protein	30.0
Crude fat	9.1
Crude fibre	72.0
Starch	581.2
Ash	14.0
Gross energy (MJ/kg)	14.3
Essential Amino Acids	
Arginine	0.7
Glycine	0.7
Histidine	1.3
Isoleucine	0.8
Leucine	1.2
Lysine	2.0
Methionine	0.1
Methionine+Cysteine	0.3
Phenylalanine	0.6
Threonine	0.6
Tryptophan	0.3
Valine	1.1

Table 2: Composition of the experimental diets containing soaked false yam tuber meal

Ingredient	Dietary level (g/kg)		
	0	120	150
Maize	595	475	445
False yam seed meal	0	120	150
Fishmeal (660 g/kg CP)	64	64	64
Soybean meal	267	267	267
Wheat bran	41	41	41
Oyster shell	18	18	18
Dicalcium phosphate	6	6	6
Lysine HCL	2	2	2
DL Methionine	2	2	2
Vitamin/mineral premix*	2.5	2.5	2.5
Salt	2.5	2.5	2.5
Calculated nutrient composition (g/kg)			
Crude protein	214.0	208.8	207.4
Lysine	13.6	12.0	12.0
Methionine	5.8	4.2	4.2
Methionine+Cystine	9.2	7.5	7.4
Metabolisable energy (MJ/kg)**	12.2	-	-

[1]Composition of vitamin/trace mineral premix per kg diet (Arosol Chemicals Ltd, India): Vitamin A, 6250 IU; Vitamin D_3, 1250 IU; Vitamin E, 25 mg; Vitamin K_3, 25 mg; Vitamin B_1, 25 mg; Vitamin B_2, 60 mg; Vitamin B_6, 40 mg; Vitamin B_{12}, 2 mg; Folic acid, 10 mg; Niacin, 40 mg; D-Biotin, 5 mg; Elemental calcium, 25 g; Elemental phosphorus, 9 g; Elemental magnesium, 300 g; Choline chloride, 500 mg; Sodium (as sodium chloride), 1.5 mg; Copper (as penta-hydrate sulphate copper), 60 mg; Cobalt (as hepta-hydrate sulphate cobalt) , 10 mg; Zinc (as zinc oxide), 150 mg; Manganese (as manganous oxide), 100 mg; Iron (as ferrous carbonate); Iodine (as potassium iodine), 20 mg; and Selenium (as sodium selenium), 1.0 mg. Lime lactobacillus spore, 0.2 million cfu.

[2]Calculated nutrient composition is based on that of tuber material soaked for 9 d (Dei *et al*., 2013) due to logistical problems at time of diet formulation. [3]ME of the SFYTM was not determined.

Table 2: Effects of soaked false yam tuber meal fed to broilers (d 21-56) on performance[1] and carcass yield[2]

	Dietary level (g/kg)			SED	P
	0	120	150		
Feed intake (g/bird/day)	111.1[a]	86.1[b]	72.0[b]	7.13	0.004
Weight gain (g/bird/day)	43.1[a]	26.3[b]	19.9[b]	2.74	<0.001
Live-weight (kg/bird)	1.85[a]	1.24[b]	1.01[b]	0.131	0.002
Gain-to-feed ratio (g/g)	0.39[a]	0.30[b]	0.28[b]	0.012	<0.001
Carcass dressing (%)	80.3[a]	76.9[b]	74.5[b]	1.32	0.013

SED-standard error difference of means, P-probability, Means in a row with same letter are not significant (P>0.05), [1]Values are means of 10 birds from 3 pens (n=30), [1]Values are means of 2 males and 2 females from 3 pens per diet (n=12; 6 per sex)