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Research Article

Tannia (*Xanthosoma sagittifolium*) Cocoyam as Dietary Substitute for Maize in Broiler Chicken

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ABSTRACT

The effects of feeding varying levels of tannia Cocoyam Meals (CCYM) as substitutes for maize were evaluated on 96, four week-old broiler chicken. The diets included raw sundried and boiled sundried tannia. Each form replaced maize at 0, 25, 50 and 100% level. The differences in weight gain, feed intake and feed conservation ratio were not significant (P> 0.05) up to 50% substitution level for both cocoyam diets . The control only differed from cocoyam diets at 100% substitution indicating that raw sundried and boiled tannia CCYM has good potentials in feeding value up to 50% inclusion levels. Feed cost and cost of daily feed intake significantly decrease (P<0.05) with increase in the level of CCYM inclusion in boiled and raw sundried tannia respectively. The level of anti-nutritional factors (phytate, oxalate, tannin and saponin) differed significantly (P< 0.01) between the raw sundried tannia (1.29, 33.32, 1.52, 6.40) and boiled tannia (0.15, 21.70, 0.14, 4.30). Thus, much better performance observed on groups fed diets with boiled cocoyam. Possibly due to heat treatment effects which destroyed the anti-nutritional factors. Therefore, with proper processing CCYM could effectively replaced maize at 50% inclusion level in finishing diets of broilers.

INTRODUCTION

The use of maize as staple food for man and as a chief energy source in livestock feeds has made it to be highly competitive in demand resulting in additional cost constraints. In order to ameliorate this problem, alternative sources of energy that are less in demand with relatively lower cost must be exploited. Besides, depending on maize alone as the sole source of dietary energy may be devastating to poultry production, because of the frequent drought and locust attack affecting some maize producing areas(Agwunobi and Essien, 1995).

Cocoyam products are recognized as cheaper carbohydrate sources than grains or other tuber crops. Thus, tannia cocoyam (Xanthosoma sagittifolium) is a non-conventional feedstuff that provides readily available energy with easily digestible carbohydrate. Xanthosoma sagittifolium is readily found in all hot and humid areas of the world as is cultivated extensively throughout West Africa (Onwueme,1982). It was suggested that tannia cocoyam are now more important than taro cocoyam (Colocasia esculenta) being more popular(FAO,1990), due to superiority of their corms and cormels in terms of energy, proteins and mineral elements(Mwenye,2009).

The nutritional quality of cocoyam compares favourably with cassava, potatoes and yam (Bello, 1976). The substitution of grains with roots and tubers is an economical question, and roots have a great potential in many areas of the world as a major supplier of energy for animals (Gohl, 1975). Although the root and tuber meal is low in protein, its energy content is remarkably high and its price, relative to maize is low, hence the cost of production will be low. However cocoyam contains anti-nutritional factors which could be a limitation to its use (Okon et al, 2007). But this limiting factors can be removed by boiling or sun-drying (Abdulrashid et al, 2006).

There is limited reference work in the utilization and inclusion of tannia cocoyam as an alternative energy source in poultry production. Therefore the objective of this study was to evaluate the effect of feeding sundried and boiled tannia cocoyam as a dietary substitute for maize on the performance of broiler chickens.

MATERIALS AND METHODS

96 Anak broiler chickens at 4 weeks old were individually weighed, and randomly allotted into eight experimental diets with two replicates containing six (6) birds per replicate. The experimental diets were isonitrogenous and isocaloric (Table 2). Tannia was used separately in boiled and unboiled forms to replace maize each at 0%, 25%, 50% and 100% levels. The samples of the test materials, sundried tannia and boiled tannia were analysed in the laboratory for the determination of phytates, oxalate, tannin, saponin and HCN (AOAC, 1975). Proximate chemical analysis of fresh sundried tannia and that of maize were done according to AOAC (1975) procedure. A conventional poultry house with deep litter floor pens was used. The treatments were arranged in a completely randomized design (CRD). Feed and water were provided *adlibitum,* and feeding trial lasted for six (6) weeks. Routine vaccination and necessary medications were administered on the birds as when necessary. Weekly records were kept on body weight gain, feed intake and feed cost. Mortality was recorded as it occurred.

All data were subjected to analysis of variance (ANOVA) procedures in determining the significant difference. Duncan multiple range test was used to separate treatment means found to be statistically significant.

RESULTS

The proximate chemical analysis of tannia cocoyam meal and that of maize are shown in table 1.While the performance of broiler chicken on varying levels of cocoyam meal as a substitute for maize in both boiled and raw sundried (tannia) cocoyam meal are presented in table 3 and 4 respectively. The results on boiled tannia indicated a linear decrease with the increase in cocoyam meal inclusion level across the dietary treatments on feed intake, weight gain, feed conversion ratio and cost of feed. The results on the levels of anti-nutritional factors (toxicants) in raw sundried and boiled tannia cocoyam are shown in table 5.

The overall highest daily feed intake 172.4g/bird and daily weight gain 57.38g/bird were obtained on 25% CCYM in boiled tannia (table 3). While the lowest values in daily feed intake 139.05 g/bird were observed on 100% CCYM in raw sundried tannia (table 4).

Table 1: Proximate composition of Tannia Cocoyam Meal and Maize

Parameters	Tannia Meal % (DM Basis)	Maize
Dry matter(DM)	28.80	87.46
Crude Protein(CP)	5.68	9.80
Crude Fiber(CF)	4.50	2.04
Ether extract(EE)	1.50	4.80
Ash	5.50	1.39
Nitrogen Free Extract(NFE)	82.82	81.97
*Energy ME(kcal/kg)	3272.97	3665.18

*Calculated using Pauzenga method(1985).

Table 2 : Ingredient Composition of Experimental Diets(Broiler Finisher Ration)

	Replacement Level			
Ingredients	0%	25%	50%	100%
Cocoyam Meal	0	12	24	48
Maize	48	36	24	0
Crayfish	2.0	2.0	2.0	2.0
Fish meal	4.0	4.0	4.0	4.0
Soya bean meal	37	37	37	37
Wheat offal	5.0	5.0	5.0	5.0
Bone meal	2.0	2.0	2.0	2.0
Salt	0.5	0.5	0.5	0.5
Vit. Min. Premix	0.5	0.5	0.5	0.5
Palm Oil	1.0	1.0	1.0	1.0
Total	100	100	100	100
Calculated Analysis				
Crude Protein(%)	22.63	22.03	21.43	20.83
ME Kcal/kg	3072.6	2977.8	2883	2793
Calcium(%)	1.24	1.30	1.35	1.46
Phosphorus(%)	0.79	0.82	0.82	0.82
Lysine(%)	1.46	1.48	1.49	1.51
Methionine(%)	0.46	0.45	0.44	0.42

Table 3: Performances of broiler finisher on varying levels of boiled tannia cocoyam meals

Parameters	Dietary treatments levels			
	I	II	III	IV
	0%	25%	50%	100%
Avg. initial live weight (g)	508.00	550.00	558.00	575.00
Avg. final live weight (g)	2830.00	2550.00	2690.00	2000.00
Avg. daily feed intake/bird (g)	167.86	172.14	155.24	151.19
Avg. daily weight gain/bird (g)	55.00	57.38	50.95	31.67
Feed conversion ratio	4.11	3.86	7.71	4.77
Mortality	0	1	0	1
Cost of Production				
Avg. cost of feed N/kg	51.13[a]	48.97[a]	46.81[a]	42.49[b]
Avg. cost of daily feed intake/b	8.58	8.43	7.27	6.42

[a,b.c] Means with different superscripts on the same horizontal row differ significantly ($p < 0.05$)

Table 4: Performances of broiler finisher on varying levels of raw tannia cocoyam meals

Parameters	Dietary treatments levels			
	I	II	III	IV
	0%	25%	50%	100%
Avg. initial live weight (g)	575.00	558.00	542.00	542.00
Avg. final live weight (g)	2730.00	2660.00	2460.00	1780.00
Avg. daily feed intake/bird (g)	160.48	166.19	158.81	139.05
	50.71	50.24	45.72	29.52
Avg. daily weight gain/bird (g)	3.17	3.73	5.37	7.30
	0	0	0	1
Feed conversion ratio				
Mortality				
Cost of Production				
Avg. cost of feed N/kg	51.13	48.97	46.81	42.49
Avg. cost of daily feed intake/b	8.21[a]	8.14[a]	7.43[a]	5.92[b]

[a,b.] Means with different superscripts on the same horizontal row differ significantly ($p< 0.05$)

Table 5: Levels of anti nutritional factors in raw sundried tannia and boiled tannia cocoyam meals

Parameters	Raw tannia	Boiled tannia	SEM	Level of significance
	As Determined (mg/100g)			
Phylate	1.29 ± 0.10	0.15 ± 0.01	0.18	* *
Oxalate	33.32 ± 0.01	21.70 ± 0.02	0.10	* *
Tannin	1.52 ± 0.02	0.14 ± 0.02	0.12	* *
Saponin	6.40 ± 0.02	4.30 ± 0.10	0.10	* *
Cyanide	1.07 ± 0.01	1.01 ± 0.20	0.27	NS

Values are means of three determinations ± SD.
** Significantly Different ($P < 0.01$).
SEM – Standard Error of the Mean.
NS – Not Significant.

DISCUSSION

The results obtained on the performance therefore indicated that, birds consumed higher and gained the highest weight in boiled tannia due to heat treatment of boiling. While birds consumed lower in raw tannia due to toxic effect of unboiled cocoyam. This could be due to the fact that boiling was more effective than sun-drying alone in reducing the level of anti-nutritional factors (Agwunobi et al, 2002).

Average cost of feed per kg decrease linearly ($P< 0.05$) with increase in the level of CCYM on boiled tannia. This was due to reduced cost of cocoyam compared to maize which has a lot of economic implications in the use of these diets. The average cost of daily feed intake significantly decreases ($P< 0.05$) with increase in the level of CCYM inclusion in raw sundried tannia (table 4). The lowest cost of daily feed intake N5.92 was observed in 100% level of CCYM in raw sundried tannia. This was due to reduced cost of the feed consumed, which indicates economic implications in the use of sundried tannia in that it saves labour and cost of burning fossil. The low daily feed intake in the control as compared with other treatment levels of CCYM inclusion in boiled tannia and raw sundried tannia, could be due to the higher energy in maize (control) diet. This agrees with the findings of Stevenson and Jackson (1997) who indicated that birds on high energy feed eat less than those on low energy diets to satisfy the energy requirement. The values on feed conversion ratio increases linearly with the increase in levels of CCYM, thus indicating that the higher the levels of CCYM, the less the utilization of the diets. This is due to inability of the birds to extract required nutrients from the feed because of the effects of anti-nutritional factors. The litter condition in all pens deteriorated as the level of cocoyam meal in the diets increased. Similar effects on litter quality was also observed by Fisher and Boorman (1986). However, this was an indication of poor process of digestion of food due to limiting factors. The best litter condition was observed in the pens housing the birds on the control diets and with those on 25% CCYM diets. Thus, recording lower values of feed conversion ratio as consequence of good nutrient uptake/utilization.

The levels of the toxicants analyzed such as phytate, oxalate, tannin and saponin significantly differ ($P< 0.01$) with lower levels in boiled tannia. While the levels of HCN (cyanide) were not significantly different ($P> 0.05$) between the two cocoyam meals. Thus the birds that fed on raw tannia have the lowest feed intake due to the toxic effect of anti-nutritional factors which reduced feed digestibility and utilization. This limiting factors leads to severe reduction in feed intake, nutrient utilization and weight gain (Esonu, et al, 1999). Perhaps most of the anti-nutritional factors combines with food to form complexes and interfere with food and mineral absorption (Abdulrashid and Agwunobi, 2009). The findings in this research study however established that cocoyam meal could therefore be acceptable and comparable to maize in feeding value. However, it was generally observed that birds on 100% raw sundried tannia passed more watery droppings than boiled. It is most likely that the heat treatment by boiling destroyed most of the anti-nutritional factors hence the better performance of birds on boiled than raw sundried cocoyam. T he trend on mortality records was not attributed to dietary effects.

CONCLUSION

The results obtained in this study revealed that tannia cocoyam meal with proper processing will effectively replace maize at 50% level of inclusion as a major source of energy in finishing diets of broiler birds for maximum profit. Since at higher level of inclusion there is reduced performance.

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