EFFECT OF RAW AND COOKED WILD COCOYAM (*Caladium bicolor*) ON THE PERFORMANCE OF BROILER CHICKS

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Abstract

The effect of raw and cooked wild cocoyam (caladium bicolor) on the performance of broiler chicks was investigated in a feeding trial that lasted for 28 days. Wild cocoyam corms were divided into two batches. One batch was ground raw and the other batch was cooked before grinding. Wild cocoyam meals so prepared were used to formulate 5 broiler starter diets at dietary inclusion levels of 0 %, 10 %, and 20 % raw and cooked wild cocoyam respectively. One hundred and twenty (120) 7-day-old Anak broiler chicks were randomly allotted to the five treatment diets in a Completely Randomized Design (CRD) and each group was further subdivided into three replicates. Measurements recorded included weight gain, feed intake feed conversion ratio and protein efficiency ratio. Results shows significant (P < 0.05) improvement in feed intake, weight gain, feed conversion ratio and PER of birds fed cooked wild cocoyam meals. Marked (P < 0.05) reduction was however, obtained in feed intake and feed conversion ratio of birds fed raw wild cocoyam diets. There was no significant (P > 0.05) difference between birds fed maize-based (control) and cooked wild cocoyam diets . Results of this experiment indicated that cooking improved the nutritive value of wild cocoyam since birds fed cooked wild cocoyam diets produced best results and that broiler chicks could tolerate up to 20 % dietary inclusion level of cooked wild cocoyam without any deleterious effect. Economics of production showed that cooked wild cocoyam diets were more profitable as regards the cost of feed per kg weight gain (₦) and thus cost savings (%)

Key words: Raw wild cocoyam, cooked wild cocoyam, broiler chicks, performance.

INTRODUCTION

Poultry production is an increasingly important agricultural industry in the world. Poultry meat and egg account for about 10 % of the total amount of all meat, eggs and milk produced in the world each year. However, as beneficial and interesting poultry seems, this sub-sector is bedeviled by high off-farm input prices particularly feed prices. This has made a greater number of poultry farmers to produce below capacity. Feed accounts for about 80 % of the total cost of intensive broiler production (Daghir, 1995; Oruseibio and Smile, 2001). This invariably has escalated the cost of poultry production prices of poultry products which is getting out of reach of the common man in most developing countries , including Nigeria

The most important and expensive feedstuffs are the energy sources, usually maize which accounts for the largest proportion of about 50-55 % of the poultry diet (Afolayan *et al*., 2002). The escalating rise in the cost of maize is brought about by its declining production conditions and stiff competition for its use by man and other livestock species (Agbede *et al.*, 2002; Hamzat *et al.,* 2003). Therefore, any successful attempt to substitute maize in poultry feed with nutritionally available alternative energy sources especially when it encourages a shift to other ingredients for which there is no competition by human. This will significantly reduce the cost of poultry production and will also enable the average Nigerian have access to poultry products.

However, the utilization of such feedstuffs necessitates having a good knowledge of the nutrient composition. Adejinmi *et al.* (2000) reported that it is essential that existing data on the chemical composition of such unconventional feed ingredients are utilized or proximate analysis be carried out before incorporation.

Wild cocoyam is a high moisture tuberous rootstock. Presently, it is not directly consumed by man and equally of no industrial use. Available literature on the feeding of wild cocoyam meals to finisher broilers suggests that it is a satisfactory energy ingredient at up to 20 % of the whole ration (Onu *et al*., 2001). However, its liberal use in monogastric animal feeding could be encumbered by the presence of some anti-nutritional factors (tannin and trypsin inhibitor), which adversely affect protein and energy utilization in broilers (Huisman, 1995; Onu *et al.*, 2001). The use of heat to inactivate these anti-nutritional factors could increase the use of wild cocoyam as a feed component in broiler diets. Heat treatment has been reported to improve the nutritive value and nutrient utilization of the unconventional feedstuffs by animals (Amaefule and Onwudike, 2000).

The objective of this study therefore, was to determine the effect of raw and cooked wild cocoyam on the performance of broiler chicks.

MATERIALS AND METHODS

The experiment was conducted at the Teaching and Research Farm (Poultry Unit), Department of Animal Science and Veterinary Medicine, Imo State University, Owerri.

Sources and processing of wild cocoyam

Wild cocoyam corms used for this study were harvested from Okirike-Nweke in Ahiazu Mbaise Local Government Area of Imo State, Nigeria. The roots and leaves attached to the corms were removed and the corms washed to remove silts and extraneous materials. Thereafter, the composite corms were peeled and divided into two batches. One batch was sliced raw to produce raw wild cocoyam meal (RWCM). While the other batch was cooked fore 30 minutes at $100^{oc,}$ allowed to cool and sliced to produce cooked wild cocoyam meal (CWCM). The raw and cooked slices were dehydrated separately using solar radiation and ground in a hammer mill.

Samples of the raw and cooked wild cocoyam meals were analyzed for their proximate composition according to the method of AOAC (1995).

Experimental diets

The wild cocoyam meals so prepared were then used to formulate five broiler starter diets such that diet 1 (T_1) was maize-based and served as the control. Diets 2 (T_2) and 3 (T_3) contained 10 % and 20 % raw wild cocoyam meal dietary levels respectively, while diets 4 (T_4) and 5 (T_5) contained 10 % and 20 % cooked wild cocoyam meal dietary levels respectively (Table 2).

Experimental birds and design

One hundred and twenty (120), one-day old Anak broiler chicks were procured from a commercial hatchery. The chicks were given *ad libitum* access to water and a commercial broiler starter diet for (7) seven days. At eight (8) day of age**,** the chicks were divided into five groups and each group randomly allotted to the five treatment diets in a Completely Randomized Experimental Design (CRD). Each group was further subdivided into three (3) replicates of eight birds each. All the birds were fed liberally throughout the duration of the experiment. During the feeding trial, heat was provided to the birds using electric bulbs. Routine poultry management practices were maintained. The feeding trial lasted twenty eight (28) days.

Economics of production

The market cost of the ingredients at the time of the study was used to calculate the total cost of the feed per 100kg of the diet, cost of feed per kg diets (₦), total cost of feed consume (₦), cost of feed per kg weight (₦) and cost saving (%).

Data Collection and Analysis

The chicks were weighed before the commencement of the trial and thereafter, the weights were taken on weekly basis using a weighing scale. At the end of the experiment, the body weight changes were calculated by subtracting the initial body weight from the final body weight. The daily weight gain was determined by dividing the body weight change by the number of days the experiment lasted.

A weighed quantity of feed was served to the birds between 6.00 am and 7.00 am daily. The leftover feed per group was collected every morning, weighed and recorded. The daily feed intake of each replicate group was determined by the difference between the quantity of feed offered and the leftover the following day.

The feed conversion ratio and protein efficiency ratio of the birds were equally computed using the formula: average daily feed intake divided by average daily weight gain and average daily weight gain divided by average daily protein intake respectively Data collected were subjected to analysis of variance according to the method of Snedecor and Cochran (1979). The differences in treatment means were separated using Duncan's New Multiple Range Test as outlined by Obi (2002)

RESULTS AND DISCUSSION

The proximate composition of both raw and cooked wild cocoyam meal is shown in Table 1 while the performance of the broiler chicks fed on the experimental diets are shown in Table 2.

The proximate composition of raw wild cocoyam meal shows that raw wild cocoyam meal contained 7.21 % crude protein, 1.48 % crude fibre, 4.60 % ether extract, 5.13 % ash and 81.58 % nitrogen free extract. Cooked wild cocoyam meal lost 0.83 % and 8.20 % of its crude protein and ether extract respectively, in the course of the cooking. The decrease in crude protein and ether extract values observed in cooked wild cocoyam could be attributed to the solubulization and leaching of nutrients into the processing water (Mbajunwa 1995; Adeyemi *et al.*, 2000). Moisture content of wild cocoyam increased in the cooked sample compared with the raw sample. Boiling in water for 30 minutes may have softened the cell tissue of the corms, increased water absorbing and water-retention capacity of the sample due to the increased permeability of the cell membrane to water (Mbajunwa, 1995).

The processing of wild cocoyam meal resulted in a significant improvement over the raw in most of the measurement recorded as shown in Table 3. Birds fed CWCM gained significantly ($P < 0.05$) higher weight than those fed RWCM. The former's weight gain was similar ($P > 0.05$) to the group fed maize-based diet. The improved weight gain of the birds fed CWCM may be associated with the beneficial effect of cooking in enhancing the nutritional value and digestibility of nutrient in CWCM. The improved digestibility could be as a result of the inactivation of the antinutritional factors, which interferes with the digestive process (Tan *et al.,* 1984; Ghazi *et al.,* 2002). The decreased weight gain observed in birds fed with RWCM suggests that nutrients in the RWCM were not as available as in the CWCM diets. Tannins and trypisn inhibitors have been reported to affect nutrient availability, utilization by monogastric animals (Kocher *et al.*, 2002). Therefore, the poor body weight of the broilers could be due to the poor digestibility and absorption of nutrients in raw wild cocoyam diets.

Feed intake of birds fed the control diet was similar (P > 0.05) to the birds fed CWCM diet. While the latter's feed consumption was significantly higher (P0.05) than those fed RWCM. The reduced feed intake observed in RWCM diets might be ascribed in part, to the taste or flavour of the diet emanating from the presence of tannins in sundried RWCM. Tannins decreases feed intake and body weight gain because of its bitter, astringent taste (Griffiths, 1991) and irritation to the alimentary canal (Singleton and Kratzer, 1969) of the birds. The higher feed intake of birds fed CWCM suggests that boiling was effective in removing the antinutritional substances in the raw corms. There may also have been improved digestibility producing faster rates o passage of digesta through the digestive tract of the birds (Ghazi *et al.,* 2002**).**

The result of the feed conversion ratio of broilers fed raw, cooked and control diets showed that the FCR of birds fed CWCM and the control diets were significantly (P < 0.05) superior to those fed RWCM. This could be attributed to the improvement in the availability and utilization of nutrient in CWCM achieved by cooking. The poor FCR of the birds fed raw WCM may not be unconnected with the effect of age of birds on the response to residual tannins and typisn inhibitor, which could be beyond the tolerable limit of the young broiler chicks. Older birds are harder than younger ones of the same specie and hence the former are expected to tolerate more of a feedstuff containing toxic substances like tannin and trypsin inhibitor in *caladium bicolor* (Akanji *et al.,* 2003).Birds fed cocked wild cocoyam diets showed better protein efficiency ratio than those fed raw diets .This probably would have resulted to the improved weight gain of birds on the cocked diets.

The economics of production as presented in Table 4 shows that feed cost per kilogram of the control diet was the highest at ₦35.53 per kilogram. Lower feed cost per kilogram liveweight gain was obtained from broilers fed wild cocoyam diets. These diets also resulted in feed cost saving ranging from 7.20 – 18.44%. This study therefore, suggests that broilers could be profitably raised on diets containing up to 20 % cooked wild cocoyam, since the birds fed 20 % cooked wild cocoyam dietary level had the lowest feed cost per kilogram weight (₦70.32) and the highest cost saving (18.44%)

CONCLUSION

It is evident from this study that cooking improved the nutritive value of wild cocoyam corms for broilers and that, it can satisfactorily substitute maize in broiler diets up to 20 % dietary level without adversely affecting growth performance of broiler chicks. Results on economics of production showed that cooked wild cocoyam diets were more profitable as regards the cost of feed per kg weight gain (₦) and thus cost savings (%). Thus, its use in poultry diet should be maximally exploited as a way of reducing the current breaking pressure on maize as major energy source in poultry diets. It will be interesting to examine higher dietary inclusion levels to ascertain more potential.

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Tab. 1. : Proximate composition of the raw and cooked wild cocoyam

Nutrients (% of DM)	Raw	Cooked
Moisture	7.31	9.30
Dry matter	92.69	90.70
Crude protein	7.21	7.15
Crude fibre	1.48	1.49
Ether extract	4.69	4.22
Ash	5.13	5.12
Nitrogen free extract	81.58	82.02
Gross energy	5.21	5.21

Tab. 2. : Ingredients and chemical composition of the experimental diets (%)

Ingredients Control Raw Cooked

	0	10	20	10	20
Maize	55.0	50.0	40.0	50.0	40.0
Wild cocoyam meal	0.0	10.0	20.0	10.0	20.0
Soya bean meal	20	20	20	20	20
Spent grain	10.0	5.0	5.0	5.0	5.0
Palm Kernel cake	3.5	3.5	3.5	3.5	3.5
Blood meal	3.0	3.0	3.0	3.0	3.0
Bone meal	3.0	3.0	3.0	3.0	3.0
Fish meal	5.0	5.0	5.0	5.0	5.0
Salt	0.25	0.25	0.25	0.25	0.25
Premix *	0.25	0.25	0.25	0.25	0.25
	100	100	100	100	100

Chemical composition (% of DM)

Crude Protein	22.33	21.70	21.40	21.68	21.38
Crude Fibre	4.72	3.77	3.77	3.72	3.73
Ether Extract	4.27	4.23	4.29	4.19	4.21
Total Ash	8.80	8.15	8.42	8.15	8.24
Nitrogen Free Extract	58.90	61.27	61.34	61.31	61.42
ME (Kcal/kg)	2.94	3.00	2.98	3.00	2.98

*To provide the following per kg of feed: Vit. A, 10, 000 IU, vit B_1, 075g, Biotin, 0.05g, Folic acid 1g, Chlorine chloride 250g Copper, 8g, Managanese, 64g, Iron 32g, Zn 40g Iodine 0.6g, Flavomycin 100g, Spiramycin 5g, 3-nitre 50g, DL-methionone, 50g, Selenium, 0.6g, Lysine 120g, BHT, 5g.

Tab. 3. : Performance of young broiler chicks to raw and cooked wild cocoyam Dietary levels of wild cocoyam (%).

Parameter Control Raw Cooked SEM						
WCW (%)	0	10	20	10	20	
Average Initial body weight (g)	105.00	104.00	106.00	105.00	105.00	0.48
Average final body weight (g)	635.00^{a}	570.00^{b}	554.00^{b}	634.00^{a}	625.00^{a}	2.26
Average body weight gain (g)	531.00^{a}	466.00^{a}	488.00^{b}	529.00^{b}	520.00^{a}	1.26
Average daily weight gain (g)	18.96^{a}	16.64^{b}	16.00^{b}	18.89^{a}	18.57^{a}	0.24
Average total feed intake (g)	1585.64^{a}	1441.20^{b}	1378.44^{b}	1581.16^{a}	1544.00^{a}	6.96
Average daily feed intake (g)	56.63^{a}	50.40^{b}	49.40^{b}	56.57^{a}	55.50^{a}	0.87
Feed conversion ratio	2.99^{a}	3.09^{b}	3.12^{b}	2.99^{a}	2.99^{a}	0.02
Average daily protein intake	12.65^{a}	11.15^{c}	10.68^{c}	12.07^{ab}	11.87^{b}	0.50
Protein efficiency ratio	1.50^{b}	1.49^{b}	1.50^{b}	1.57^{a}	1.56^{a}	0.03

$^{a, b}$ and ^{c} Means within a row having different superscripts differ significantly (P<05)

Tab. 4. : Economics of production of broiler chicks fed experiment diets (Dietary levels of wild cocoyam %).

Parameter Control Raw Cooked					
WCW (%)	0	10	20	10	20
Cost of feed/kg (₦)	35.53	32.08	28.49	32.10	28.50
Cost of total feed intake (₦)	54.75	45.27	39.27	50.75	43.95
Cost of daily feed intake (₦)	1.96	1.62	1.40	1.81	1.56
Cost of feed/kg weight gain (₦)	86.22	79.42	70.88	80.01	70.32
Cost saving (%)		7.90	17.80	7.20	18.44

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