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Effect of processed wild cocoyam corm meal (caladium bicolor) on the growth and carcass characteristics of broiler birds

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ABSTRACT

The study was designed to determine the effect of feeding graded levels of processed wild cocoyam corn meal (Caladium bicolor) on the performance and carcass characteristics of broiler birds. One hundred Anak broilers of one week old were randomly assigned to five treatment groups with five replicates. Conventional broiler diets were formulated with 0%, 2.5%, 5.0%, 7.5% and 10.0% inclusion levels of processed wild cocoyam corn meal (PWCCM), and designated as T1, T2, T3, T4 and T5, respectively. Feeding trial was carried out for twenty-eight days during which, growth and carcass characteristics of the chicks were determined. The result of the study revealed that up to 10% PWCCM could be used in formulation of broiler starter diet; however, optimum performance was achieved at 7.5% inclusion level. Furthermore, the study maintained that 7.5% of PWCCM may be included in broiler starter diet without any deleterious effect on the carcass characteristics of the chicken. This entails 32.5% reduction in feed cost.

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1. Introduction

In the developing economies, emphases are placed more on both quantity and quality of products (Ahaotu et al., 2010a). The need to satisfy hunger becomes paramount where scarcity of even basic staple foods exists. The per capita intake of animal protein of people in developing countries such as Nigeria remains very low (Madubuike et al., 2009). This situation is worsening, because other sources of cheap animal protein such as wild animal and other micro-livestock such as bush rats, snails, grass cutters are being depleted as a result of deforestation, bush fires, indiscriminate and uncontrolled hunting (Ahaotu et al., 2008). However, there has been a huge diversification in poultry production in recent times to meet the shortfall in animal protein intake such that broiler meat has become a common food item on the table of most urban dwellers.

In poultry production, feed cost claims the largest share of the total expenses involved in the production process. Feed alone accounts for over 75% of the total cost of production, out of which 50% is expended on protein and energy sources (Ahaotu et al., 2010b). The unavailability and expensive nature of cereals (maize and sorgum) stemming directly from its use as staple human food as well as major feed ingredients in Nigeria creates the problem of rising feed costs. This unprecedented increase in the cost of feed has made the price of poultry products beyond the reach of the average Nigerian (Obioha, 1992). The solution naturally, is to increase the production of these cereals commonly used in poultry feed so as to cater for the needs both man and his livestock (Ahaotu and Ekenyem, 2009). But, as this cannot work owing to the continuous increase in human and livestock production, attempts should be made to replace these expensive energy supplements in poultry feeds with man conventional and cheaply sourced ingredients which the humans cannot consume but are cherished by livestock, so as to sustain the efficiency and profitability of poultry industry (Madubuike et al., 2003).

An approach that seems to have the greatest potentials products is the evaluation of the alternative feed sources including wild cocoyam, which are not usually consumed neither by humans nor some livestock species. It was felt that wild cocoyam could be an untapped energy source that can substitute maize, which is currently the plague and limiting factor in the expansion of poultry and poultry feed industry.

To date, there is very little information on the compositional or nutritional characteristics of these under exploited alternative feedstuff (Gomez, 1982; Onwueme and Sinha, 1992; Ullman, 1998). Wild cocoyam as feed ingredients to poultry and other livestock has not been explored. This neglect is understandable and has been largely due to dependence upon conventional feedstuff in the formulation of conventionally compounded feeds. The utilization and incorporation of wild cocoyam into broiler feed will go a long way in increasing broiler production, conceive the Nations Foreign exchange used in importation of cereals and finally reduce the pressure on the major energy source in broiler rations.

2. Materials and methods

2.1. Experimental site

The experiment was carried out at the Teaching and Research Farm of Imo State Polytechnic, Owerri, Imo State, Nigeria. The study area is situated in the South East geopolitical zone of Nigeria with an annual rainfall range of 2000mm - 2484mm and average temperature of 26 0C (IMLS, 2010).

2.2. Experimental birds

A total of one hundred and twenty day-old Anak strain broiler chicks were procured from Gofons Hatchery in Owerri, Imo State, Nigeria. The chicks were maintained on commercial starter feed (Pfizer brand) and brooded for one week for stabilization. After one week, 100 chicks were selected on the basis of apparent viability and good conformation and randomly assigned to five dietary treatments of twenty birds per treatment. Each treatment group was replicated into four places, that is four chicks per replicate.

2.3. Processing of the wild cocoyam corn meal

Fresh and blooming wild cocoyam (caladium bicolor) corns were harvested within the Imo State Polytechnic Agronomic farm and its environs. The corns were chopped, boiled for three hour and dried to 10% moisture content. Boiling was done to eliminate the raphides (are crystals of calcium oxalate) present in the corn which is responsible for irritating and acidic taste of wild cocoyam corn. The dried chopped corns were then milled using a

hammer mill with a sieve size of 3.15mm to produce the meal. Proximate analysis of the corm meal was conducted at the college of Animal Science and Livestock Production using standard methods (AOAC, 1995) to determine the percentage crude protein, crude Fiber, total ash, ether extract, crude lipids and Carbohydrates. The mineral analysis was carried while gross energy was determined with a Gullenkamg oxygen adiabatic bomb calorimeter. The proximate composition and mineral analysis of PWCCM is presented in Table 1.

Table 1
Chemical composition of processed wild cocoyam corn meal (Caladium bicolor).

Ingredients	Processed wild cocoyam meal%
Chemical Composition	
Dry Matter content	70.7%
Crude protein	5.0%
Crude Lipids	0.6%
Crude Fibre	3.9%
Carbohydrate	26.3%
Ether Extract	1.50%
Total Ash	2.3%
Metabolisable energy	3730K Cal/Kg
Minerals and vitamins	**mg/100g**
Calcium	39
Iron	1.7
Phosphorus	78.89
Potassium	540.85
Sodium	9.25
Iron	1.52
Carotene Trace	67
Thiamin	0.18
Riboflavin	0.04
Niacin	0.9
Ascorbic Acid	10

2.4. Formulation of the experimental diets

Five experimental broiler starter chick diets containing 0%, 2.5%, 5%, 7.5% and 10% PWCCM were formulated using common feedstuff (Table 2) and designated as treatments 1, 2, 3, 4 and 5, respectively. The ingredients were thoroughly mixed to ensure homogeneity and milled in a hammer mill. The feed was fortified with vitamin premix and synthetic amino acids in line National Research Council recommendation (NRC, 2004). The proximate nutrient composition of the compounded diets is also shown in Table 2.

2.5. Feeding and brooding

The experimental birds were divided according to five dietary treatments in a deep litter house made up of one hundred birds and replicated four times in a completely randomized design. All brooding facilities were available such as polyethylene sheets for controlling air movement into the brooder house, regular source of heat and light with 200 watts electric bulb in each replicate pen. Adequate number of feeders and drinkers were provided for the chicks to achieve ad libitum access to feed and water.

2.6. Data collection and analysis

Initial weights of the birds were measured at the inception of the experiment (8 days old), while live weight was subsequently measured on weekly basis to evaluate growth rate. The weight at the end of the experiment (4 – weeks old) was measured as the final weight, while feed intake was measured by subtracting the weight of feed remnant from that of the feed supplied the previous day. Data were also collected on weight gain, by subtracting the initial weight from the final weight. Feed conversion ratio was obtained by dividing the average feed intake (kg) by the weight gain (kg) and the feed cost was calculated as the sum of all the items included in a diet. Data were

collected from each treatment groups and subjected to one-way analysis of variance, Steel and Torrie (1980), while the Duncan Multiple Range Test as outlined by Gordon and Gordon (2004) was used to separate differences in means.

Table 2
Ingredient Composition of Experimental Broiler Starter Diet.

Ingredients	**T1**	**T2**	**T3**	**T4**	**T5**
PWCCM	0.0	2.5	5.0	7.5	10.0
Maize Grain	10.0	7.5	5.0	2.5	0.0
Soyabean Meal	25	25	25	255	25
Wheat Offal	20	20	20	20	20
Spent Grain	6	6	6	6	6
Fish Meal	8	8	8	8	8
Bone Meal	6	6	6	6	6
Oyster Shell	3	3	3	3	3
Common Salt	0.3	0.3	0.3	0.3	0.3
Palm Kernel Cake	15	15	15	15	15
Groundnut cake	6	6	6	6	6
Broiler Premix	0.3	0.3	0.3	0.3	0.3
Lysine	0.25	0.25	0.25	0.25	0.25
Methionione	0.15	0.15	0.15	0.15	0.15
Total	100	100	100	100	100
Calculated nutrient composition of the experimental diets					
Nutrients	%19.30	18.00	17.92	17.58	16.00
Crude protein	% 3.62	3.30	3.04	2.90	2.10
Ether Extract	%3.54	3.98	4.36	4.70	4.82
Crude Fibre	%3.66	3.86	3.94	4.23	4.52
Calcium	%1.89	1.84	2.00	2.36	2.79
Phosphorus	%0.92	0.84	0.82	0.75	0.62
Lysine	%				
Methionine + Cystine	%0.32	0.30	0.28	0.24	0.21
ME (Kcal/Kg)	2600	2682	2730	2762.52	2865

2.5kg of premix/tonne contain, Vitamin A10, 000 I.U; Vitamin D3 20,000 I.U; Vitamin E 12,000 I.U; Vitamin K 2.5g; Thiamine 1.5 g; Riboflavin 5g; Pyriboflavin (B6) 1.5g; Vitamin B12 1.0mg; Biotin 2mg; Niacin 15g; Panthothenic acid 5g; Zinc 50g; Iron 25g; Copper 5g; Iodine 1.4g; Selenium 100mg; Cobalt 300mg; B.H.T. 25g.

Table 3
Performance of Starter Broilers Birds Fed Processed Wild Cocoyam Corm Meal Diets.

Parameters	**T1**	**T2**	**T3**	**T4**	**T5**	**SEM**
Initial Live Weight (g)	96	95	95	90	90	0.40ns
Final Live Weight (g)	1800a	1700b	1695b	1600c	1565d	0.55*
Daily weight Gain (g)	44a	40a	35b	30c	25e	0.02*
Daily Feed Intake (g)	104a	100a	95b	90c	85d	0.04*
Feed Conversion Ratio	2.36a	2.5a	2.71a	3.0b	3.4c	0.13*
Feed Cost/kg Weight	201.66a	185.15b	164.46c	136.06d	120.04e	0.04*

a, b, c, d, e means within the same row with different superscripts are significantly different ($p<0.05$).
NS, = Not Significant
*,=Significant ($p<0.05$).

3. Results and Discussion

The performance characteristics of the starter broiler birds (Table 3) showed that significant differences (P<0.05) existed between birds in the various treatments for total feed intake, daily weight gain, final live weight, feed conversion ratio and feed cost per kg gain. Birds on the control diet (T1) were significantly (P<0.05) heavier than those T2 and T3, which were significantly (P<0.05) heavier than birds on T5.Performance of broilers fed the control diet (T1) was similar to those fed diet T2 processed wild cocoyam corn meal containing diets. The feed intake reduced with increase in the levels of PWCCM. Addition of 2.5% maize grain and 7.5% PWCCM improve feed intake suggesting that energy was not the reason for the trend in feed intake observed. The improvement in weight gain of the birds fed diets with supplement maize grain relative to those without maize grain was attributed to the extra caloric effect accompanied with a reduced feed passage time in the gastro-intestinal tract. This allowed increased utilization of other constituents of the diets similar to that reported by Kay and Gooding (2007), Grueling (1966), Ahaotu (2004) and Onu et al. (2001). Consequently, birds fed 10% PWCCM (T5) consumed more feed than those of other treatments did in an attempt to satisfy their body requirements (Gomez, 1982; Feltwell and Fox, 1998). Increasing level of PWCCM reduced nutrient availability and thus reduced weight gain. Bulkiness, raphides and semi powdery nature of PWCCM diets appeared to be the major limiting factors in PWCCM utilization in broiler diets. Ahaotu, (2004), Makkar et al. (2007), Onu et al. (2008), and Kay and Gooding (2007) suggested that enzyme and probiotic supplementation of PWCCM can be used to suppress the anti-nutritional effect of raphides and calcium oxalates and results in improvement of production efficiency.

The feed cost per kg weight gain reduced with increasing levels of PWCCM thereby reducing the cost of broiler production. This agrees with the results reported by Onu et al. (2001) and Ahaotu (2004) in which the utilization of various PWCC meals were compared and similar results obtained.

The carcass characteristics of Starter Broilers Birds Fed Processed Wild Cocoyam Corm Meal Diets followed the same trend with the growth performance of the chicks (Table 4). The values obtained in this study fall within the range recorded by Ziegler (1964).

Table 4
Carcass Characteristics of Starter Broilers Birds Fed Processed Wild Cocoyam Corm Meal Diets.

Parameters	T1	T2	T3	T4	T5	SEM
Drum Stick (cm)*	7.4	7.0	6.9	6.8	6.5	1.22ns
Wing length (cm)*	13.8a	13.5a	13.4a	12.5b	19.2b	0.30*
Body length (cm)*	19.7a	17.8a	16.9b	16.8b	15.8a	0.21*
Thigh length (cm)*	15.8a	13.0c	12.5c	11.4c	11.4c	1.24*
Hearth Girth (cm)*	15.2a	17.0a	19.3b	21.6c	23.6c	0.44*
Average live weight (gm)*	410.8a	427.3b	445.8c	462.3d	499.3e	0.32*

Abcde, means within same row having different superscripts were significantly different (p<0.05).
*, Significant (p<0.05).
NS, Not significant (p>0.05).

4. Conclusion

The result of this trial suggested that PWCCM could be incorporated in broiler starter diets up to 10% but optimum performance appeared to be obtained at 7.5% inclusion level. The cost of broiler birds' production is observed to have significantly reduced following the inclusion and increasing levels of PWCCM in the diets thereby reducing cost of poultry production and by extension making poultry meat affordable to consumers.

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