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EFFECT OF REPLACEMENT OF MAIZE WITH CASSAVA ROOT MEAL FORTIFIED WITH PALM OIL ON PERFORMANCE OF STARTER BROILERS

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ORIGINAL ARTICLE

ABSTRACT: *The effects of replacement of maize with cassava root meal fortified with palm oil on performance of starter broilers were determined in a 28-day feeding trial. Five experimental broiler starter diets were formulated such that diet T_1 (control) contained 60% maize. Diets T_2, T_3, T_4 and T_5 were formulated such that they contained cassava root meal (%), fortified with palm oil (%) in the proportions of 8:2, 16:4, 24:6 and 32:8 respectively, in replacement of maize. The diets were fed to broilers in a completely randomized design experiment replicated thrice. Each replicate contained 10 birds. Birds fed T_2, T_3 and T_4 diets had statistically ($P>0.05$) similar daily feed intake and daily weight gain values with the control group except T_5 birds that had significantly ($P<0.05$) lower daily feed intake and daily weight gain. Feed conversion ratios of the birds on cassava root meal and palm oil diets compared favorably with the control except for the T_5 group which recorded a significantly ($P<0.05$) higher feed conversion ratio. The least cost (US$ 0.85) per kg meat produced was recorded with the birds on T_1 diet and followed by the T_3 (16:4%) birds. It is therefore concluded that maize as a dietary energy source in poultry diet is nutritionally superior to cassava root meal fortified with palm oil.*

Key words: *Chicks, cassava root meal, palm oil, performance*

INTRODUCTION

The high cost of maize arising from inadequate maize production and competing use of the available feedstuff for human consumption and animal feed (Okorie, 1982; Ohwofa, 1993; Oyedeji, 2002). This has contributed to the unprecedented increase in feed costs to the point of it constituting over 90% of poultry farm recurrent expenditure (Igboeli, 2001).

One of the major challenges to researchers in the tropics is the provision of alternative feeds for monogastric animals. Maize a conventional feedstuff has remained the major energy source in compounded diets for poultry and other non-ruminants. The various uses to which maize is being committed, such staple food for man, brewing and confectionary, has placed additional cost constraints on its continued use in poultry diets. The solution is to explore the use of alternative feed ingredients, hitherto under exploited by poultry farmers (Udedibie et al., 2004; Durunna et al., 2005). Among the alternative feedstuff which could be used as energy sources for poultry diet even though it is lower in protein and other essential nutrients (Longe and Oluyemi, 1977; Odukwe, 1994).

However, one serious set - back in the use of cassava as feedstuff for monogastric is it content of cyanogenic glucosides, linamarin and lotaustralin, which on hydrolysis inside the animal body produces hydrogen cyanide which is highly toxic (Nartley, 1973; Hill, 1977). Okeke (1980) reported that for cassava root meal to be used in poultry diets, it has to be processed so as to reduce its total cyanide content from 360 mg kg^{-1} to about 15 - 20 mg kg^{-1}. Various methods have been devised for detoxifying cassava root meal. These include cooking (Okeke et al., 1985), soaking in water (Rajaguru, 1975), sun drying (Odukwe, 1994), and use of additive (Obioha et al., 1984; Odukwe, 1994). Tewe et al. (1980) and Formunyam et al. (1980) have reported that sun-drying and the addition of palm oil have been shown to be effective in reducing the rate of hydrolysis of cyanogenic glycosides in cassava to produce hydrogen cyanide.

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However, there is a paucity of information on the effect of replacement of maize with cassava root meal fortified with palm oil on performance of broiler chicks. The objective of the current investigation was to study the effects of replacement of maize with cassava root meal fortified with palm oil on the performance of starter broilers.

MATERIALS AND METHODS

Experimental location

This research was conducted at the Poultry Unit of the Teaching and Research Farm of the Department of Animal Science and Technology, Federal University of Technology, Owerri, Imo State. Owerri is situated in south-eastern agro-ecological zone of Nigeria, and lies between latitude 4°4' and 6°3' N and longitude 6°15' and 8°15' E. The agro-climatic data of Owerri has been reported by MLS (1984).

Procurement and processing of cassava root meal

Fresh cassava tubers were purchased at Umunze in Anambra state, Nigeria. The cassava tubers were sliced into 1cm thick flakes for effective drying. The sliced cassava tubers were sun dried for about nine hours for nine days. The dry cassava flakes were milled using a hammer mill (screen size) to produce cassava root meal before they were incorporated into the rations.

Composition of diets

Five experimental broiler starter diets provided as a mash were formulated such that diet T_1 (control) contained 60% maize. Diets T_2, T_3, T_4 and T_5 were formulated such that they contained cassava root meal, fortified with palm oil (%) in the proportions of 8: 2, 16: 4, 24: 6 and 32: 8 respectively, in replacement of maize. The chemical composition of the cassava root meal and maize are shown in Table 1. In addition, the calculated chemical compositions of the formulated diets are shown in Table 2.

Table 1 - Proximate composition of cassava root meal and maize

Component	Cassava root meal	Maize
Moisture content (%)	14.10	12.00
Crude protein (%)	3.22	8.50
Crude fibre (%)	5.00	2.80
Ether extract (%)	0.50	4.24
Ash (%)	2.65	1.35
Nitrogen free extract (%)	74.53	71.10
HCN (mg/100g)	3.46	-
ME* (kcal/Kg)	2235.40	3001.20

*Determined according to Morgan et al. (1975): HCN - Hydrogen cyanide; ME - Metabolisable energy

Table 2 - Ingredients composition of the experimental diets (%) for broiler starter

Component	Dietary treatment				
	Control (T_1)	T_2	T_3	T_4	T_5
Maize (%)	60.00	50.00	40.00	30.00	20.00
Cassava root meal (%)	-	8.00	16.00	24.00	32.00
Palm oil (%)	-	2.00	4.00	6.00	8.00
Calculated chemical composition					
Crude protein (%)	21.50	21.02	21.11	21.10	21.01
Crude fibre (%)	3.80	4.13	4.47	4.81	5.14
Ether extract (%)	3.86	5.46	7.07	8.65	10.23
Ash (%)	3.32	3.43	3.54	3.67	3.77
ME (Kcal/kg)	2932.31	2931.79	2931.75	2931.52	2931.10

*Each diet contained 24% Soybean bean meal, 2% Palm kernel cake, 3% Wheat offal, 4% fish meal, 3% Blood meal, 2% bone meal, 1% oyster shell, 0.25% lysine, 0.25% Methionine, 0.25% vitamin/mineral premix and 0.25% common salt. ME – Metabolisable energy.

Experimental birds and their management

One hundred and fifty (150) day old unsexed broiler chicks of Hybro strain were procured and weighed. They were randomly allotted to five treatment groups of 30 birds each, with ten birds constituting a replicate, in a completely randomized design (CRD). The birds were raised under identical environmental and management conditions. Feed and water were provided *ad-libitum*. The broilers were weighed individually in all the groups and average weight determined at the beginning of the experiment and weekly thereafter. The experiment lasted for 28 days.

Parameters measured

Initial live weights of the birds were taken. Daily feed intake was determined by the difference between the quantity of feed offered the previous morning and the quantity of leftover the following morning. Weight gain was

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determined by obtaining the difference between initial weight of each group and its final weight on the 28th day of the experiment. Data on feed intake and weight gain were used to calculate the feed conversion ratio. Feed conversion ratios were calculated by dividing the total feed intake per bird by total weight gain. Feed cost per kilogram (kg) was calculated based on the prevailing market prices of ingredients. Data collected were subjected to analysis of variance and Duncan's New Multiple Range Test used to detect differences among means (Steel and Torrie, 1980).

Economic analysis

Cost analysis was carried out at the end of the feeding trial to assess the economic viability of ingredient used. The cost kg^{-1} feed ingredient used and that of the diets were noted. The mean feed intake was used to calculate the mean cost of feed consumed by the birds under each treatment.

RESULTS

The data on effects of replacement of maize with cassava root meal (CRM) fortified with palm on the performance characteristics of starter broilers are presented in Table 3. There were significant ($P<0.05$) reductions in average daily feed intake, average final weight gain and average daily weight gain of starter broilers fed T_5 diet relative to the groups fed T_1, T_2, T_3 and T_4 diets. Feed conversion ratio of birds on T_5 diet was significantly ($P<0.05$) higher than that of the groups fed T_1, T_2 and T_3 diets. However, feed conversion ratio for the birds fed control diet was not different from ($P>0.05$) to birds fed T_2, T_3 and T_4 diet. Similarly, there were no significant differences in cost of feed and cost of feed/kilogram meat produced ($P<0.05$) among the groups.

Table 3 - Effects of replacement of maize with cassava root meal fortified with palm oil on body weight gain feed intake, feed conversion ratio and feed cost analysis of starter broilers

Parameters	Replacement levels of palm oil fortified cassava root meal					SEM
	T_1	T_2	T_3	T_4	T_5	
Avg. initial body wt. (g)	130.35	130.33	130.34	130.31	131.32	0.41
Avg. final body wt. (g)	1279.37^a	1183.08^a	1183.08^a	1135.89^a	976.38^b	51.09
Avg. daily wt. gain (g/day)	41.04^a	37.60^a	37.60^a	35.91^a	30.18^b	1.83
Avg. daily feed intake (g/d)	87.00^a	84.00^a	83.00^a	83.00^a	74.00^b	2.23
Feed conversion ratio	2.12^b	2.23^b	2.19^b	2.31^{ab}	2.45^a	0.06
Cost analysis						
Cost of feed (US$ /Kg)	0.40	0.39	56.80	0.40	0.40	-
Cost of feed / Kg meat (US$)	0.85	0.89	0.87	0.92	0.97	-

^{ab}Means within a row with different superscripts are significantly ($P<0.05$) different; SEM- Standard error mean

DISCUSSION

The proximate composition of maize revealed a lower metabolisable energy (3001.20 Kcal/kg) value when compared with the values of 3440 kcal/kg and 3432 Kcal/kg reported by Obioha (1992) and Aduku (1990) respectively. The cassava root meal used in the present study is lower in both crude protein (3.22%) and metabolisable energy (2235 Kcal/Kg), but higher in fibre (5.0%) relative to maize which had 8.50%, 3001.20 Kcal/Kg and 2.80% for crude protein, metabolisable energy and crude fibre respectively. The moisture content values for maize (12.00%) and cassava root meal (14.10%) used in the present study were slightly higher than 12.25% for cassava root meal and 10.50% for maize earlier reported by Uchegbu (2005).

The superiority of T_1 diet over the other is evidence that maize, as an energy source, is nutritionally to palm oil fortified cassava root meal The significant reduction in weight gain of birds fed T_5 diet support the results of (Jensen et al., 1970; Longe and Oluyemi, 1977) that reported linear decrease in weight gain of birds resulting from the increase in the quantity of cassava root meal included in the ration. The residual cyanogenic glucosides present in cassava root meal could not be associated with poor performance of birds fed T_2 – T_5 diets as sun-drying is known to reduce the level of these compounds to the point where they have no negative effect on the animal (Tewe, 1991; IITA, 1994; Akinfala et al., 2002). Synthetic DL - methionine was also included in the diet and this amino acid can help to detoxify the hydrogen cyanide (HCN), through its transformation to the more innocuous thiocyanate (Tewe and Egbunike, 1992; Tewe, 1994)

This depressed performance in birds fed T_5 diets could be connected with the poor protein quality of T_5 diet relative to the control diet (T_1). This is also in agreement with the proximate biochemical compositions of maize (8.5 % CP, 4.24 % EE, 2.8 % CF, 1.35% ash and 3001.20 kcal/kg ME) and cassava root meal (3.22 % CP, 0.5% EE, 5.0 % CF, 2.65 % ash and 2235.40 kcal/kg). Adding palm oil (fat) to poultry feed is normal and acceptable because this addition has been shown usually to increase metabolisable energy of the whole diet beyond that expected from the fat itself (Jensen et al., 1970; Olomu, 1995). The non-significant higher final live weights of birds fed T_2 and T_3 diets as observed in the present study further support the earlier report by Nwoche et al. (2001) that 4% dietary

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inclusion of palm oil as the best inclusion level that will bring about an optimum growth in broilers. The significant value of feed intake of birds fed T_5 diet is an indication of reduction of quantity of feed consumed by the birds. It is therefore likely that on balance the protein provided by the cassava root meal fortified with palm oil was of rather inferior quality compared with that from the maize.

The feed conversion ratio of the control birds was better than that of the groups fed T_5 diet. The cost of starter broiler diet per kilogram ranged from US$ 0.39 to US$ 0.40, the cost being reduced with increasing levels of cassava root meal and palm oil in the diet (Table 3). The significant increase in the feed conversion ratio of starter broilers fed T_5 diet indicated relatively poorer feed utilization. This result shows that 1kg meat is produced cheaper with control diet as it recorded the lowest feed cost (US$ 0.85) for 1 kg broiler meat produced followed by birds fed T_3 diet (US$ 0.87). The highest cost for the group fed T_5 diet (US$ 0.97) could be attributed to the high cost of palm oil in the market as at the time this investigation was carried out.

CONCLUSION

Results from the study suggest that maize as a dietary energy source in poultry diet is nutritionally superior to cassava root meal fortified with palm oil. Nevertheless replacing maize with cassava root meal/palm oil (%) in proportions of 8:2, 16:4 and 24:6 also gave a comparable result to birds fed T_1 diet. The study presented herein has strongly shown that cassava root meal fortified with palm oil has a very bright future as a feed ingredient in broilers. It is therefore suggested that the use of palm oil fortified cassava root meal as a partial replacement for maize in poultry diets be further explored to ascertain the best inclusion level needed for optimal performance.

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