Effect of replacing maize with cassava/brewers dried yeast blend (Cassayeast) on performance of broiler chicks and feed cost in southern Nigeria

B.M. Oruwari¹, A.O. Anibo and D.M. Nkanta*

Animal Science Department, *Agricultural Economics and Extension Department, University of Science and Technology, P.M.B. 5080, Nkpolu, Port Harcourt, Rivers State, Nigeria.

Abstract

A feeding trial using 240, day old Anak broiler chicks was conducted in which cassava meal (CM) completely replaced maize in the control diet (A) to formulate five isocaloric and iso nitrogenous diets. Dried CM blended with brewers dried yeast (BDY) formed cassayeast with 2.704 parts of CM to 1 part of BDY. The (Cassayeast) CM and BDY blend in the dietary treatments, (B, C, D and E) were 30 CM + 11.1% BDY, 35 CM + 12.94% BDY, 40 CM + 14.79% BDY, and 45 CM + 16.64% BDY, respectively, and these treatments had no maize. Dietary treatment A, containing maize, which served as the control had no cassayeast inclusion, thus demonstrating the total replacement of maize by cassayeast in the other dietary treatments. Results showed that significant of maize difference ($P < 0.5$) were observed in the control and at in one cassayeast treatment in feed intake (4.43 as against 4.22kg), body weight (1.94 as against 1.65kg), efficiency of feed utilization (feed: gain ratio 2.19 as against 2.51; gain: feed ratio 0.49 as against 0.43), respectively. However, gizzard weights were not significant. Economic analysis showed that the cost of producing a bird with the maize based diet (A) was significantly ($P < 0.05$) higher than that with the cassayeast diets but there was not difference among the cassayeast diets (B-E). The maize based diet was most expensive (₦ 29.68 per kg diet) while diet C was the cheapest (₦ 25.57 per kg). The study demonstrated that the use of cassayeast has a place in the broiler industry, thus indicating that with proper protein balancing, cassava can completely replace maize in broiler diets.

Keywords: Cassava, brewers dried yeast, broiler chicks, feed cost.

Introduction

Feedstuffs for poultry feeds have become increasingly scarce in Nigeria and this is greatly accentuated by the high cost of production of feedstuffs, especially grains which are the major energy sources. The keen competition between man and poultry for grains has been implicated in the rising cost of poultry products (Ademosun and Eshiett, 1980). The universal feed grain, maize, the basis of commercial poultry feeds, is utilized at rates between 40 to 70% (Say, 1989), thus it is the ingredient with the highest cost in

all nutritionally balanced poultry feeds in Nigeria. Moreover, pressure from population growth, drought, excessive rainfall, inorganic fertilizer cost, and intensive poultry production have made this conventional feed grain, maize, insufficient and therefore, expensive. The rising cost of poultry feeds because of the high cost of maize necessitates a research for cheaper and locally available feedings stuff such as cassava. Moreover, cost increases occur because of price increases in inorganic fertilizer which is indispensable in commercial maize production. On the other hand, cassava is well produced in

¹Corresponding author

Southern Nigeria and middle belt without inorganic fertilizer since it is tolerant to drought and poor soil conditions. Indeed, well processed, dry, cassava meal stands as a ready alternative to maize in Nigerian livestock feeds (Erubetine and Adejobi, 2000; Tewe, 1982) although cassava is considered as a staple food in sub-Saharan Africa (IITA, 1994). A major problem of cassava meal utilization is its powdery nature (Essers and Nout, 1989, Tewe and Egbunike, 1989). A solution to this problem could be the grinding of the cassava along with an oil seed such as soybean (Erubetine and Adejobi, 2000) of sun dried, low moisture BDY like the type used in this study. In the cassayeast blend, this type of BDY was chosen because of its availability, protein content, and as a source of unidentified growth factor (UGF) in poultry diets (Potter and Sheton, 1978, Jenson *et al.*, 1978, Amakiri *et al.*, 1998). This study was therefore, conducted to investigate the cheapest

way to use cassava to completely replace maize in broiler diets.

Materials and Methods

Peeled cassava (TMS – 30555), sundried and subjected to hydrogen cyanide (HCN) test (Ezeala and Okoro, 1986) was milled using hammer mill to produce cassava meal (CM with a proximate analysis (crude protein 2%, fat 1.3%). Brewers dried yeast (BDY) procured from a local drier (Aba, Imo State, Nigeria) was subjected also to approximate analysis (crude protein 28.0%, fat 4.8%) before the blend was made. Blends of CM and BDY were made in proportions to achieve approximately 9% crude protein (CP) which is equivalent to the CP in the maize used in the control treatment. Accordingly, a ratio of 1 part BDY: 2.704 parts of CM was worked out to produce four blends (cassayeast) and the proximate analysis is shown in Table 1.

Table 1 *Analysed proximate composition of cassayeast*

	%
Crude protein	9.01
Fat	2.25
Crude fibre	9.56
Ash	4.00
ME (calculated)	11.67MJ/Kg

Five isocaloric and isonitrogenous starter (21% CP, 11.59MJ/kg, ME) and finisher (19%CP, 12.09 MJ/kg, ME) diets were formulated (Table 2 and 3).

Table 2 *Composition % and unit cost of experimental diet for broiler starter*

Ingredient	A	B	C	D	E
Maize	55	-	-	-	-
P.K.C	-	55	14.5	7.1	-
S.B.M	30	30	29.7	31	32
Wheat offal	11.14	13	-	-	61.64
Cassayeast	-	41.1	47.94	54.79	2.6
Palm Oil	-	6.5	4	3.35	0.25
Vit/Min Premix	0.25	0.25	0.25	0.25	3.00
Bone meal	3	3	3	3	0.11
D-L Methionine	0.11	0.15	0.11	0.11	0.4
Salt	0.4	0.4	0.4	0.4	0.1
Lysine	0.1	0.1	0.1	0.1	0.1
Price of feed/kg ₦	29.68	27.12	25.57	25.32	25.64

Table 3 *Nutrient composition*

Crude protein	20.53	20.74	20.88	20.49	20.71
ME	11.65	11.63	11.55	11.57	11.56
Cal.	3.01	7.75	4.79	3.78	2.77
Fat	9.6	11.5	8.3	8.10	6.5
Crude fibre	4.06	5.12	7.05	7.78	8.27
Ca	1.11	1.14	1.05	1.09	1.08
P	0.61	0.61	0.66	0.67	0.67
Lysine	1.14	1.39	1.50	1.45	1.51
Methionine	0.48	0.52	0.49	0.49	0.52

¹ Containing per kg vitamin and mineral mixture 0.15g retinal, 25 mg cholecalciferol, 4.5 DI- α -tocopherol, 1g menadone busulphite, 3g riboflavin, 12.5 nicotinic acid, 5.5g pantothenic acid, 0.5g pyridoxine, 0.25g folic acid, 5mg cobalamin, 125g choline chloride, 62g antioxidant, 12.5g Fe, 40 Mn, 25g Zn, 1g Cu, 0.6g I, 0.1g Co, 0.05g Se.

² All calculated composition except crude protein and fat which were analysed.

Dietary treatment A, the control contained 55% maize and no cassayeast while the other four (B,C,D,E) contained only cassayeast and no maize. Thus, the cassayeast in dietary treatments B,C,D, and E which were (30 CM + 11.1% BDY = 41% Cassayeast), (35 CM + 12.94% BDY = 47.94% Cassayeast), (40 CM + 14.79% BDY = 54.79% cassayeast) and (45Cm + 16.64% BDY = 61.64% cassayeast) respectively, completely replaced maize used in the control treatment. The diets were analysed for CP and fat only while nutrients were calculated on the basis of the feed ingredient composition data used (Parr *et al.*, 1988).

Management of Birds

Two hundred and forty, day-old broilers chicks (Anak) were weighed in groups of 12 chicks and randomly allocated to twenty pens (1 x 1.5m each) in an open-sided house. Management procedures including vaccination were uniform for all the birds. The birds were randomly assigned to the five dietary treatments which were replicated four times by the completely randomized designed, thus each of the 20 pens started with 12 chicks. The starter diets were four weeks of the eight weeks experimental period. Experimental diets and water were provided *ad libitum*.

At the end of each period of seven days, the bird were weighed individually to determine body weight gain and feed consumption for the calculation of feed gain ratio, and gain:feed ratio. Feed consumption was calculated by difference between the quantity offered and the quantity left. Final body weight of every surviving bird was taken in each replicate at the end of the eight-week. Mortality was recorded promptly to effect adjustment in the weekly calculations of feed utilization. Post mortem examination performed on four dead birds, in treatments B and D in the seventh week, showed that the mortality was due to coccidiosis and not due to dietary treatments. At the end of the eight weeks experimental period, five birds from each replicate were weighed and slaughtered to determine breast muscle weight, liver and gizzard weights. These were calculated as percentage of individual body weights. Feed cost per bird was calculated by taking the total cost of all the ingredients that constituted the starter and finisher rations which were consumed by each bird in each of the dietary treatments and the value divided by the body weight gain of the bird. The prevailing market prices of maize and equivalent cassayeast were taken into account in determining the economics of feeding cassayeast to broilers as an alternative source to maize for a profitable broiler

production. All data collected were subjected to analysis of variance and treatment means separated by using the Multiple range test of Duncan (1955).

Results

Treatments mean feed intake, body weight, efficiency of feed utilization (gain:feed and feed: gain) are shown in Table 4. The intake of the control, maize based diet (A) was significantly ($P<0.05$) higher than the cassayeast diet, but the intake of diets C (47.94% cassayeast) and B (41.1% cassayeast) were significantly higher ($P<0.05$) than diets

E(61.64% cassayeast) and D (54.79% cassayeast). Birds in treatment A gained significantly ($P<0.05$) higher body weight than birds in the cassayeast based diets. In these diets, birds in diets C and B significantly ($P<0.05$) gained higher body weight than those in diets D and E. Birds in diet A had the best feed utilization (Feed:gain: Gain:feed) while those in diet E had the least feed utilization being significantly ($P<0.05$) lower than all the dietary treatments. The mean weekly feed intake and body weight gain are presented in figures 1 and 2 respectively.

Figure 1: Mean Weekly Feed Intake

Figure 2: Mean Weekly Body Weight Gain

Table 4 Effects of cassayeast on the final body weight, feed intake, feed efficiency and feed conversion ratios of broilers at 8 weeks of age.

Measurements	Treatment				
	A	B	C	D	E
Cum. Feed intake(kg)	4.43 ^c ± 0.04	4.31 ^b ± 0.06	4.37 ^b ± 0.04	4.22 ^a ± 0.17	4.28 ^a ± 0.05
Final body weight(kg)	1.92 ^c ± 0.02	1.75 ^b ± 0.05	1.77 ^b ± 0.08	1.67 ^a ± 0.07	1.65 ^a ± 0.04
Feed:Gain ratio	2.19 ^c ± 0.05	2.4 ^b ± 0.54	2.36 ^b ± 0.08	2.38 ^b ± 0.35	2.51 ^c ± 0.57
Gain:Feed ratio	0.49 ^c ± 0.13	0.45 ^b ± 0.12	0.46 ^b ± 0.11	0.45 ^b ± 0.09	0.43 ^b ± 0.12

Means are ± SEM of 4 replicates of 12 broilers each

^{a,b,c} Means within the same row with different superscripts are significantly different from one another (P<0.05)

The result of economic analysis of other experimental feeds are shown in Table 5. It was observed that dietary treatment A was the most expensive (N 29.68/kg diet) while diet C was the cheapest (N 25.57/kg) cost of production was found to be significant (P<0.05).

Discussion

The observed significantly (P<0.05) higher feed intake of birds in treatment A (Control) compared with those in the cassayeast diets agreed with the report of (Babiker *et al.*, 1991) who reported that feed intake was lowered at 25, 50 and 75% cassava replacement of maize. In this study feed intake received as cassava increased in the cassayeast diets. However, it disagreed with the report that method of processing and level of tapioca inclusion did not affect intake significantly (Bandey and Gowdh, 1992). Birds in treatments B and C significantly consumed more feed than the other cassayeast diets, but since the dietary treatments were isocaloric, the difference in feed consumption may be caused by a physical limitation such as palatability, fibre level or eye and respiratory tract irritation (Parr *et al.*, 1988). Although, palatability is not a widely accepted concept for feed intake by poultry, these unconventional diets may require the broilers to take a fairly

long adaptability time. Ensiminger and Olentine (1978) noted that one of the problems militating against the use of BDY in poultry diets is its bitter taste which can depress feed intake. This study, moreover, exceeded the recommended inclusion level of 5% (Parr *et al.*, 1988, 9.26%(Ergul., 1988), and its local preparation could not avoid high level of fibre which can depress feed intake (Heuser *et al.*, 1945) although crude fibre was not analysed in this study (Table 1 and 2). Considering the high level of cassava due to prussic acid (Parr *et al.*, 1988) could influence the observed low feed intake in the cassayeast diets. However, the residual cyanide in the cassava used was very low (0.072mgHCN/10g) when compared with the maximum tolerant level in livestock diets (0.5 to 1mg HCN/10g) as reported by Ingram (1975). Although, the body weight show that the control, maize based diet, yielded the highest body weight, the yields of birds in treatments B and C, which gained significantly (P<0.05) higher than those of treatments D and E, were substantially comparable with those of the control. Whereas the growth rate of broilers fed on cassava meal was found to be satisfactory (Suchmann, 1994) the observed comparable body weights in the cassayeast diets B and C may have been potentiated by the BDY which

usually contain UGF (Amakiri *et al.*, 1998). Similar to the findings of Pido *et al.*, (1979) the growth rate, in this study, corresponded with the pattern of feed intake in all the dietary treatments. The results of efficiency of feed utilization (feed:gain, gain:feed) showed significant ($P<0.05$) difference between the control and the cassayeast dietary treatments; and between treatment E and the other cassayeast based diets. However, the efficiency of cassayeast based diets up to 54.79% (treatment D) inclusion was still comparable to acceptable standards (Parr *et al.*, 1988). Considering that in previous studies cassava partially replace maize (Pido *et al.*, 1979; Babiker *et al.*, 1991; Banday and Gowdh., 1992; Suchmann, 1994), the results of this study demonstrated that broiler chicks can utilize in their diets up to 40% cassava without maize or other grains and still achieve a competitive result provided cassava is fortified to about 9%CP (which most varieties of maize contain). By the fortification of cassava (CM and BDY blend) cassayeast was basically considered to be equal to maize at least in CP content. Since economical high efficiency rations can easily be formulated for all phases of poultry production by using maize and correctly processed soybean meal (Patrick and Schaible, 1980) cassayeast as an ingredient in poultry feeds may be justified as its use produced an improved economy of feed utilization (feed:gain) compared with that obtained with the maize-soybean meal diet (treatment A).

In this study, gain:feed ratio was calculated to determine the biological status of BDY fortified cassava meal (cassayeast) in place of maize in broiler diet. Although the maize-soybean meal diet (control) had a significantly ($P<0.05$) higher gain:feed ratio than all the cassava-based dietary treatments, the comparable efficiency of treatments B,C and D tended to demonstrate that the use of fortified cassava (cassayeast) to completely replace the maize portion of a broiler

diet has a place in the broiler industry, especially in areas where maize is scarce but has surplus cassava. The weekly body weight as demonstrated in Figure 2 corresponding with that of the feed intake pattern figure 1 showed a remarkable difference between the control and the cassayeast dietary treatments up to the 6th week. A sharp drop was observed in both body weight gain and feed intake after week six treatments A and C, and then D and E dropped in the 7th week while B was somewhat steady. For the 6th to the 8th week, indicating that the highest weight gain was attained in week six. Indeed, the observed exponential feed intake between the 4th and 6th weeks caused the accelerated growth within this period, in this study. This finding agreed with the demonstration that body weight is directly related to feed intake and requirement (Patrick and Schaible, 1980). Accordingly, body weight gain was reduced between weeks 6 and week 8 because feed intake decreased slightly in during that period thus confirming that weight gain showed corresponding pattern as feed intake. The decline in weight gain in weeks 7 and 8 could be attributed to intestinal coccidiosis, an epidemic parasitic disease in the university research farm, which manifested in the flock by the 7th week. It has been reported that coccidiosis reduced absorption of nutrients from the intestinal tract, resulting in slow growth and low feed efficiency (Gordon, 1979; Patrick and Schaible, 1980). Economics analysis of the experimental diets demonstrated cost/benefit of the various diets considering that the feed that gives the best conversion ratio may not be the most economical to use. Feltwell and Fox, 1979; Nesheim *et al.*, 1979; Oruwari *et al.*, 1995). The data showed that the cost of producing a bird with diet A was significantly higher ($P<0.05$) than the cassayeast diet while there was no difference ($P>0.05$) than the cassayeast dietary treatments (Table 5).

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Table 5 *Economic analysis of experimental diets.*

Measurements	Dietary Treatment				
	A	B	C	D	E
Cost (₦)/kg starter	29.89	27.12	25.60	25.32	25.64
Cost (₦)/kg finisher	29.47	25.44	25.54	26.02	25.78
Av. Cost (₦)/kg	29.68	26.28	25.57	25.67	25.71
Feed intake (kg)/Bird	4.432	4.312	4.366	4.220	4.250
Body weight (kg)/Bird	1.94	1.75	1.77	1.67	1.65
Cost of feed (₦)/Bird	131.07 ^b	111.40 ^a	111.57 ^a	109.10 ^a	110.19 ^a
Cost of feed (₦)/kg	67.66 ^b	63.59 ^a	63.13 ^a	65.63 ^{ab}	66.82 ^a
Body weight					
Total Cost (₦)/diet	6,291.36	5,347.20	5,355.36	5,236.80	5,289.90
Feed Cost (₦)/ton	29,680.00	26,280.00	25,236.80	25,670.00	25,710.00

Means are $\pm$ SEM of 4 replicates of 12 broilers each

^{a,b,c} Means within the same row with different superscripts are significantly different from one another ($P < 0.05$). Dietary ingredient and cost (₦)/kg were: Yellow maize, 27; cassava, 19; BDY, 8 cassayeast 16; PKC, 9; Bone meal, 20; Vit-min premix, 160; Salt, 15; SBM, 38; D-L methionine, 650; Lysine 750; wheat offal, 10; oil, 70.

This table also showed that the cost of using the control diet A to produce a unit weight of chicken was higher ($P < 0.05$) than that for diets B and C, but not higher ($P > 0.05$) than that for diets D and E. This cost/benefit analysis indicated that dietary treatment C (47.94% cassayeast) followed by feed B were most economical in producing a unit weight of broiler chicken despite the fact that feed A gave the best feed efficiency and conversion ratios. The result, therefore, confirmed the findings of Feltwell and Fox (1978) and Nesheim *et al.*, (1979), and suggested that the unit cost of feed used in producing a unit of poultry meat should be given the greatest importance rather than the conversion ratio of the feed. By this analysis commercial and biological considerations tended to be at a balance, thus supported the report that a ration must be economically and nutritionally balanced (Henry and Dyfed (1985). In the five dietary treatments, being isocaloric and isonitrogenous, it was observed that BDY used was the cheapest ingredient. Furthermore, the cassayeast diets could have been cheaper, but for the high cost of palm oil used. This was the third most expensive ingredient, the first being the synthetic amino acids, and then the

vitamin/mineral premix. The effect of palm oil on the prices of cassayeast diets in this study agreed with the observation of Church (1979) who reported that vegetable oils generally command better prices for chicken and industrial use, to the extent that they are usually priced out of use for animal feeds.

The results of this study introduced cassayeast as an ingredient that can completely replace maize in a broiler diet. The blend of 35CM + 12.94% BDY was found to be the best for optimal performance of the broiler chickens since at this mixture commercial and biological considerations tended to be at a balance.

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