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Performance, Carcass Characteristics and Economy of Production of Broilers Fed Maize-Grit and Brewers Dried Grain Replacing Maize

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Abstract: A 28-day feeding trial involving ninety-six (96) four weeks old broiler chicks was conducted to investigate the effect of total replacement of maize with different combination ratios of maize grit and Brewers Dried Grain (BDG) on the performance, carcass characteristics and economy of finisher broilers. Four experimental diets were formulated by substituting maize with maize grit and BDG in the ratio of T_1 (0%); T_2 (3:1-45 + 15); T_3 (1:1-30 + 30) and T_4 (1:3-15 + 45) respectively. The birds were randomly assigned to four treatment diets. Each experimental unit of 24 birds was replicated twice giving 12 birds per replicate in a completely randomized design (CRD). Feed and water were provided *ad-libitum*. Body weight and weight gain per feed intake through higher at high cost with the control diet improved in cheaper diets formulated with maize grit and BDG. There was no consistency in the carcass characteristics of the groups particularly among the internal organs showing that dietary maize grit ad BDG could not pose any discernible nutritional problems that might manifest in the carcass of the broilers. Cheaper feed formulated with maize grit and BDG gave the higher gross margins especially diet 4.

Key words: Performance, carcass, economy of production, maize grit-brewers dried grain, maize, broilers

Introduction

The cost of producing poultry feeds has been on the increase in Nigeria over the last three decades. This is attributable to inadequate production of maize, which is a major energy source in poultry feed, coupled with stiff competition between man and livestock over the available grains. Feed for monogastrics consist of 50-60 percent energy sources and this has remained a major set back in poultry production, since the chief energy source is relatively scarce and expensive. Esonu *et al*. (2002) had observed that feed alone accounts for 70-80 percent of cost of poultry production in Nigeria. Importing maize into the country could drain much of the scarce foreign exchange.

There is therefore the need to embark on intensive research in a bid to discover alternative energy source which are readily available, attracting little or no competition between man and livestock hence encouraging production at reduced cost. Some industrial by products such as maize grit Brewers' Dried Grain (BDG), or a combination of them, could serve as the alternative energy source in poultry diet (Olumu, 1988). These by-products which are not directly utilized by humans are available and are likely to be more available with the increasing number of industries discarding them in Nigeria.

Maize grit and BDG though spent in terms of their starch content, do actually contain proportionately more valuable vitamins, minerals, fat, fibre and protein than were contained in the original cereal grain used (Kingsell *et al*., 1979; Singh, 1988). This research was therefore to determine the effect of the use of maize grit and BDG as substitutes for maize on performance and carcass characteristics of finisher broilers. It also investigated the cost effectiveness of the use of maize grit and BDG over maize in finisher diets.

Materials and Methods

One hundred (100) day-old chicks of Anak breed raised for five weeks on broiler starter ration, comprising of the same experimental ingredients (proximate composition is shown in Table 2, were used for the study. At the end of the starter phase (five weeks) four mortality was recorded, the remaining ninety-six (96) birds were weighed and randomly distributed into four treatment groups. Thereafter they were fed for nine weeks with four broiler finisher diets formulated with maize, maize grit, and brewers' dried grain in the ratios of T_1 (0%); T_2 (3:1-45 + 15); T_3 (1:1-30 + 30); and T_4 (1:3-15 + 45) respectively (Table 3).

Each treatment group of 24 birds were replicated two times giving 12 birds per replicate. The birds were managed in a deep litter pen measuring 3.06x5m per pen, in a completely randomized design (CRD). Feed and water were supplied *ad-libitum*. Necessary vaccines and antibiotics were administered at appropriate period. Litters were change on weekly basis.

Data collection and statistical analysis: Records of feed intake, body weight, weight gain, feed conversion ratio, mortality were maintained. Proximate analysis of maize grit, Brewer's dried grain and the diets were determined, according to standard methods of AOAC, (1980). Carcass characteristics were determined by weighing live birds, dressed birds and dismembered body parts. All data collected were subjected to Analysis of variance (ANOVA), (Snedecor and Cochran, 1980). The means were separated for test of significance by using Duncan's Multiple Range Test as outlined by Steel and Torrie (1980).

Results and Discussion

The proximate composition of maize grit and BDG is presented as Table 1, and the proximate composition of starter diets in combination ratios of maize grit and BDG is shown as Table 2.

The composition of starter diets in combination ratios of maize grit and BDG is shown as Table 2. The composition of the experimental broiler finishers is shown as Table 3. In Tables 4, 5 and 6 the effect of total replacement of maize with levels of maize grit and BDG on performance, carcass characteristics, and economy are presented respectively.

Results of total replacement of maize with combinations of maize grit and Brewers' Dried Grain on the performance of finisher broilers are presented in Table 4. Performance indices showed that body weight and weight gain of birds placed on the control diet were significantly ($P < 0.05$) higher, compared to the other treatment groups (T_2, T_3, T_4), which were not significantly ($P > 0.05$) different in weight gain. The higher body weight gain observed with the control diet could be due to high energy value of the diet accruing from full starch content of pure maize. This could perhaps be a level where the caloric to protein ratio is balanced to enhance performance (Bartov *et al.*, 1974).

Depression in growth in terms of body weight ad weight gain recorded in T_4 might be the result of high protein level with low energy density of the diet. This is in agreement with Sunda (1956) that rations low in energy and high in protein content reduced growth and efficiency of feed utilization. Feed intake was significantly ($P < 0.05$) higher in treatments 3 and 4, but lower in the control (T_1). This reduction in feed intake observed in the control group could be traceable to the high metabolizable energy (ME) concentration of the diet which reduced feed intake but improved feed utilization. This observation upholds the report of the Dean (1985) that feed intake reduced and feed conversion ratio (FCR) improved as the energy density of diets increased.

Similarly, increase in feed intake recorded in treatment 4 could have arisen from the high fibre content with low energy density of the diet accruing from high level inclusion of BDG. Increase in fibre content of a feed leads to reduction in energy compelling birds to eat as much as they can to satisfy their energy requirements. This is in line with the view of Moran (1977) that high fibre diets tend to increase feed intake in birds.

The best feed to gain ratio was recorded from birds fed the control diet. This may be attributed to low fibre content of the diet since fibre in the diet of monogastrics impairs utilization of other nutrients especially crude protein (Deloreme and Wojcik, 1982). Treatments 3 and 4 had the highest value of feed to gain ratio. This poor utilization of feed could also be due to high fibre inclusion. This agrees with the work of Babatunde *et al.* (1975) who showed that values of feed to gain ratio increased with increase in fibre in diets.

The effects of replacement of maize with maize grit and BDG on the carcass characteristics of broilers are

Table 1: Proximate composition of Maize Grit and BDG

	Maize grit	BDG
Moisture content	14.40	-
Dry matter	85.60	90.00
Crude protein	13.21	28.64
Crude fibre	4.80	12.46
Ether extract	4.02	6.50
Energy (Kcal/gm)	2.60	2.84

Table 2: Proximate composition of the starter Diets used (Composition of maize grit and BDG)

	T_1	T_2	T_3	T_4
	0:0	3:1	1:1	1:3
Crude protein	21.60	25.60	14.10	29.27
Crude fibre	5.12	9.57	7.72	8.56
Ether extract	3.66	4.57	4.95	5.38
ME/Kcal/kg	2.74	2.31	2.30	2.29

Table 3: Composition of the experimental diets (Broiler Finisher)

	Ratios of maize grit and BG inclusion (%)			
	T_1 0:0	T_2 3:1	T_3 1:1	T_4 1:3
Ingredients (%)	0	(45+15)	(30+30)	(15+45)
Maize	60.00	-	-	-
Maize grit	-	45.00	30.00	15.00
Brewers Dried Grain	-	15.00	30.00	45.00
Soya bean meal	12.0	12.00	12.00	12.00
Palm kernel cake	8.00	8.00	8.00	8.00
Wheat offal	8.00	8.00	8.00	8.00
Fish meal	3.00	3.00	3.00	3.00
Blood meal	3.00	3.00	3.00	3.00
Bone meal	5.00	5.00	5.00	5.00
Vitamin premix	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00
Proximate composition (%) DM				
Crude protein	17.58	22.38	24.60	25.78
Crude fibre	4.14	6.43	7.47	8.51
Ether extract	4.04	4.56	5.07	5.57
ME (Kcal/kg)	2.83	2.32	2.31	2.29

*Premix contained per kg Ratio, Vit. A 10,000 IU; Vit D_3 1.500 IU; Vit. E 3IU; Vit K 2 mg; riboflavin, 3 mg; panthothenine acid 6 mg; niacin 15 mg; Vit B_{12} 0.08 mg; folic acid, 4 mg; Mn, 8 mg; Zn, 0.5 mg; Iodine, 1.0 mg; Co, 1.2 mg; Cu, 10 mg; Fe, 20 mg.

Table 4: Effect of Total Replacement of Maize with Levels of Maize Grit and BDG on the Performance of Finisher Broilers

	Levels of inclusion				
	T_1	T_2	T_3	T_4	
Parameters	0:0	3:1	1:1	1::3	SEM
Initial body wt (g)	820.00	820.00	820.00	820.00	0.00
Final body weight (g)	2260.00^a	2220.00^b	2210.00^b	2200.00^b	13.14
Daily weight gain (g)	51.00^a	50.00^b	49.60^b	49.30^b	0.39
Daily feed intake (g)	119.50^b	120.90^b	122.10^a	122.30^a	0.65
Feed conversion ratio (FCR)	2.34^b	2.40^b	2.50^a	2.50^a	0.04
Morality	3.00	2.00	3.00	3.00	
Cost of feed (N/kg)	480.90^a	29.40^b	27.09^a	24.69^c	2.18
Feed cost/kg weight gain (N)	112.50	70.78	67.73	61.73	

a' b' c: Means within rows with different superscripts are significantly different (P < 0.05)

Table 5: Effect of Replacement of Maize with Maize Grit and BDG on Carcass Characteristics of Broilers (% Live weight)

	Treatments				
Parameters	T_1	T_2	T_3	T_4	SEM
Live weight	2.26^a	2.22^b	2.21^b	2.20^b	0.007
Dressed weight (%)	66.65^a	76.03^b	66.97^b	67.05^b	0.091
Thigh (%)	18.35^b	19.32^b	18.46^a	18.17^a	0.26
Breast (%)	38.61^a	37.46^b	38.50^a	37.64^a	0.28
Neck (%)	2.31^a	2.84^b	2.26^a	2.51^b	0.131
Gizzard (%)	2.17^a	2.21^a	2.21^a	2.31^a	0.031
Kidney (%)	0.14^a	0.12^{ab}	0.09^{bc}	0.06^c	0.016
Liver (%)	2.41^{ab}	2.54^b	2.86^b	1.80^b	0.21
Heart (%)	0.39^a	0.38^a	0.45^b	0.39^a	0.018
Abdominal fat (%)	0.54^a	0.26^a	0.48^a	0.98^a	0.36

abc means in the same rows bearing different superscripts arte significant (P < 0.05)

shown in Table 5. The carcass characteristics used to assess the effect of replacement of maize with maize grit and BDG are dressed weight as percentage of live weight, the breast muscles, the thigh muscles and the neck. The internal organs evaluated are the gizzard, the kidney, liver, heart ad the abdominal fat. The results show the following values for live Wight: 2.26, 2.22, 2.21 and 2.20 kg for T_1, T_2, T_3 and T_4 respectively. There was no significant difference between the live weight of T_2, T_3 and T_4 ($P < 0.05$) but there was significant difference in live Wight between T_1 and the other treatments ($P < 0.05$).

The dressed weight (%) were 66.65, 76.03, 66.97, and 67.05 for T_1, T_2, T_3 and T_4 respectively. There was a significant difference ($P < 0.05$) between T_1 and the other treatments while T_2, T_3 and T_4 were similar ($P > 0.05$).

The thighs (%) were 18.35, 19.32, 18.46, and 18.17 for T_1, T_2, T_3 and T_4 respectively. There was a significant difference ($P < 0.05$) between T_2 and other treatments (T_1, T_3, and T_4) which did not differ. The breast (%) were 38.61, 37.46, 38.50 and 37.64 for T_1, T_2, T_3 and T_4 respectively. There was a significant difference between T_2 and other treatments ($P < 0.05$) and the other treatments did not differ significantly ($P < 0.05$). The necks (%) were 2.31, 2.84, 2.26 and 2.51 for T_1, T_2, T_3 and T_4 respectively. There was a significant difference between T_2 and T_1, T_4 ($P < 0.05$) and T_2 did not differ from T_4 ($P < 0.05$); T_1, T_3, and T_4 were also not significantly different ($P < 0.05$). The Gizzard (%) were 2.17, 2.21, 2.21 and 2.31 for T_1, T_2, T_3, and T_4 respectively. There was significant difference between T_4 and T_1, T_2, T_3 ($P < 0.05$). The kidneys (%) were 0.14, 0.12, 0.09 and 0.06 for T_1, T_2, T_3 and T_4 respectively. There was a significant difference ($P < 0.05$) between T_1, and T_3; and between T_1 and T_4 but T_1 was the same with T_2. Also T_2 was the same with T_3 the livers (%) were 2.41, 2.54, 2.86 and 1.80 for T_1, T_2, T_3, and T_4 respectively. There was a significant difference between T_2 and T_3; and also between T_2 and T_4 ($P < 0.05$) although T_2 and T_1 were the same but T_1 did not also differ from T_3 and T_4 ($P < 0.05$). the hearts (%) were 0.39, 0.388, 0.45 and 0.39 for T_1, T_2 T_3 and T_4 respectively. There was a significant difference between T_3 and the other treatments ($P < 0.05$). The abdominal fat (%) were 0.54, 0.26, 0.48 and 0.98 for T_1, T_2, T_3 andT_4 respectively. There was a significant different between T_4 and the other treatments ($P < 0.05$), which did not differ among themselves.

The cost of feed consumed by birds to obtain a unit of product (marginal cost in production) and/or the Gross margin values have been suggested by Ukachukwu and Anugwa (1995) to be useful in assessing the bioeconomics of feed in poultry production. This and other economic indices are shown in Table 6. the table shows that the cost of diet containing conventional maize (T_1 or control) was significantly higher ($P < 0.05$) than the cost of diets containing graded levels of maize

Table 6: Economic Indicators from Broilers Fed Maize Grit and Brewers' Dried Grain as Substitutes for Maize

	Treatment diet					
Economic indices	T_1	T_2	T_3	T_4	P	SEM
Cost of diets (N/kg)	48.09[a]	29.49[b]	27.00[b]	24.69[bc]	0.0001	1.268
Cost per wt gain (N/kg)	112.50[a]	70.78[b]	67.73[bc]	61.73[bc]	0.0001	2.750
Av Variable Cost (N/Bird)	216.37[a]	132.71[B]	121.91[bc]	111.11[c]	0.0001	5.710
Av. Wt at point of sale (kg)	2.26[a]	2.22[b]	2.21[b]	2.20	0.0001	0.007
Av. Revenue* (N/Bird)	621.50[a]	610.50[a]	607.75[c]	605.00[d]	0.0001	4.859
Gross margin (N/Bird)	405.13[b]	477.79[a]	485.84[a]	493.89[ac]	0.0001	4.855

a' b' c Means bearing superscripts in the same row are significantly different (P < 0.05). * Price of chicken = N275/kg

grit and Brewers, dried grain (T_2, T_3 and T_4). This difference arose from the costs of maize, maize grit and BDG. While maize was purchased at N53.00 per kg, maize grit was bought at N26.00 per kg and the BDG bought at N10.00 per kg. Diet T_4 was significantly lower in cost P < 0.0r) than the other diets with graded levels of maize grit and BDG (T_2 and T_3). The cost per weight gain and the average variable costs were highest in the maize-based diet (T_1) and significantly (P < 0.05) different from the values in the other (maize grit, BDG-based) diets (T_2, T_3 and T_4).

The average weight of birds fed the different diets at the point of sale differed significantly. However, birds fed diets T_3 and T_4 were significantly lower in weights (P < 0.05) than birds fed commercial feed (T_1). The weight of birds fed diets T_2 and T_3 were not different from each other.

The revenue differed between the different diets. This was because the costs affected the gross margins negatively. The highest gross margin was recorded with diet T_4 Diets T_2 and T_3 equally gave high gross margins but their values were statistically not different from each other. These were significantly (P < 0.05) higher than the gross margin recorded with maize-based diet (control). In terms of economy of feed, substituting maize with maize grit and BDG at various ratios gave cheaper rations in treatments 2, 3 and 4 with improved weight gains. This observation is in line with the report of Okerie *et al.* (1998) that replacing maize with wet-milling byproducts proved more efficient in the performance of broilers with reduced cost compared to the control diet. Since most broiler farmers are in commercial production with the aim of making good profit, it is advisable for them to formulate their diets substituting maize with maize grit and BDG, preferably as in T_4.

Conclusion: Maize grit and brewers' dried grain can be used to formulate poultry diets in which maize is completely replaced. The performance of birds fed diet 2 compared very closely with the birds fed the control diet and therefore a good formulation for finishing broilers. There was no consistency in the carcass characteristics of the groups particularly among the internal organs showing that dietary maize grit and BDG could not present any discernible nutritional problems that could clearly manifest in the carcass of the broilers. It is cheaper to finish on diets formulated with maize grit and BDG than with maize-based Commercial feed, in Nigeria. The lower diet cost of such formulation with high feed to weight gain ratio guaranteed higher gross margins.

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