ECONOMIC RESPONSE OF FINISHER BROILER CHICKS FED GRADED LEVELS OF UREA FERMENTED BREWER'S DRIED GRAINS GROUNDNUT CAKE BASED DIETS

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Abstract

The response of finisher broilers fed graded levels of urea-treated and fermented brewers dried grains in place of groundnut cake was investigated. Urea-treated and fermented brewer's dried grains were used to replace groundnut (GNC) at 0, 25, 50, 75 and 100% levels in broiler finisher diets. Diets were formulated to be isonitrogenous and isocaloric to provide 20% crude protein and 3000 Kcal/kg metabolizable energy. One hundred and ninety-five chicks (Anak breed), aged 35 days, were randomly allotted to five treatments having three replicates per treatment at 13 chicks per replicate, and 39 chicks per treatment. The chicks were placed in rearing cages and fed and received *ad libitum* feeding treatment and general management on equal weight basis. At 56 days of age, the mean body weight, weight gain, feed intake and feed: gain ratio were not significantly ($P > 0.05$) different in all treatment groups. Economic analysis showed cost reduction and better savings with urea-treated and fermented brewer's dried grains diets. Mortality level (5 – 7%) was normal and evenly spread across all treatment groups.

Keywords: Urea-treated, fermentation, brewer's dried grains, groundnut cake, finisher broiler chicks.

Introduction

Groundnut cake (GNC) is one of the conventional agro-industrial by-products regularly incorporated into poultry feeds as a plant protein source. The continued rise in the cost of groundnut and groundnut by-products due to the high demand by man and animal has created the need for an alternative. A cheaper alternative to GNC which is readily available and not directly required by man and can supply the same quality protein as the conventional by-products is needed (Isikwenu, 2006). Brewer's dried grains (BDG) a by-product of the brewery industry has been found to have an amino acid profile similar to GNC Table 1 (Aduku, 1993). Although BDG has a relatively lower crude protein (27.90%) content than GNC (45%), (Aduku, 1993), the differences in their crude protein content is a quantitative issue but not qualitative which is more important (Isikwenu, 2006). The major limitation to the use of BDG as a source of plant protein is its high proportion of crude fibre content (Onwudike, 1993; Ademosun, 1973; Richardson *et al*, 1958). Increased use of BDG will require further processing in order to reduce its fibre level (Isikwenu, 2006). Alkali treatments have been used to improve the nutritional quality of various crop residues or by-products (Faniyi *et al*, 1997; Faniyi and Ologhobo, 1999; McDonald *et al.*, 1995). The use of urea treatment and fermentation of BDG is expected to breakdown and reduce the fibre content and therefore make it possible to incorporate higher amounts of BDG as a plant protein source in poultry feed. Urea-treated and fermented BDG have been successfully used in broiler starter diets as a replacement for GNC up to 16.70% of the diet without detrimental effects (Isikwenu *et al.*, 2008). This study is aimed at investigating the effects of replacing GNC with urea-treated and fermented BDG in broiler finisher diets.

Materials and Methods

Experimental Site

This study was carried out in the Poultry Research Unit of the Department of Animal Science, Delta State University, Asaba Campus, Nigeria with mean annual rainfall, temperature and relative humidity of 1300mm, 33.7°C and 82% respectively. Asaba lies on latitude 5°30` and 5°45`N of the equator and longitude 5° 40` and 6° E of the Greenwich Meridian.

Preparation of Test Ingredient

The BDG used in this experiment was treated and fermented for 7 days using 2% urea concentration. 2% urea solution was obtained by dissolving 400g of urea (46% N, fertilizer grade) in 20 litres of clean water, to produce a solution containing 20g urea per litre of water (Adeleye, 1988).

Experimental Diets

Urea-treated and fermented BDG was used to replace groundnut cake at 0, 25, 50, 75 and 100% graded levels in finisher broiler diets on protein equivalent basis. Five diets were formulated to be isonitrogenous and isocaloric to provide 20% crude protein and 3000 Kcal/kg metabolizable energy. Diets were adequately supplied with vitamins and minerals. The composition of the finisher broiler diets are presented in Table 2.

Table 1. Chemical composition of Groundnut cake (GNC) and Brewer’s Dried Grains (BDG)

Chemical Components	GNC	BDG
Crude protein	45.00	27.90
Ether extract	9.16	7.40
Crude Fibre	3.81	11.70
Ash	5.51	4.80
Calcium	0.20	0.30
Phosphorus	0.60	0.88
TDN	76.00	78.00
ME Kcal/kg (Swine)	3185.00	2240.00
ME kcal/kg (Poultry)	2530.00	2513.00
Lysine	1.73	0.90
Methionine	0.44	0.60
Cystein	0.72	0.40
Arginine	5.00	1.30
Tryptophan	0.49	0.40

Table 2: Composition of Experimental Finisher Broiler's Diets

	Dietary Treatments				
Replacement Levels (%)	100 GNC 00 UTBDG	75 GNC 25 UTBDG	50 GNC 50 UTBDG	25 GNC 75 UTBDG	00GNC 100 UTBDG
Ingredients					
Maize (Yellow)	58.20	57.18	55.60	54.45	52.85
Groundnut cake	21.50	16.12	10.75	5.38	-
Urea Treated BDG	-	6.30	13.00	19.32	26.00
Fish meal	2.50	2.50	2.50	2.50	2.50
Blood meal	3.50	3.50	3.50	3.50	3.50
Wheat offals	5.00	5.00	5.00	5.00	5.00
Rice bran	1.00	1.00	1.00	1.00	1.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Oyster shell	1.50	1.50	1.50	1.50	1.50
Palm oil	2.60	2.70	2.95	3.15	3.45
Premix (finisher)*	0.50	0.50	0.50	0.50	0.50
Salt	0.50	0.50	0.05	0.50	0.50
Methionine	0.2	0.2	0.2	0.2	0.2
TOTAL	100.00	100.00	100.00	100.00	100.00
Calculated analysis					
Crude Protein (%)	20.13	20.04	20.06	19.98	19.98
Metabolizable energy (Kcal/kg)	3007.50	3002.89	3001.63	3001.49	3002.89
Determined analysis					
Dry matter (%)	90.55	91.07	89.95	90.48	88.95
Crude Protein (%)	20.29	20.37	20.45	20.54	20.69
Crude fibre (%)	6.85	6.90	7.33	7.36	7.51
Ether extract (%)	2.55	3.07	3.17	3.55	3.65
Ash (%)	9.33	10.12	10.40	11.45	11.45
Nitrogen free extract	51.53	50.61	48.60	47.58	45.65

**Vitamin-mineral premix provided the following vitamins and minerals per kg of diet: A 8000iu, D_3 18000 iu, E20iu, K2.0mg, B_1 1.55mg, B_2 4.4mg, B_6 2.35 mg, B_{12} 0.013mg, Biotin 0.042 mg, Niacin 23.5mg, Pantothenic acid 6.5mg, Folic acid 0.65mg, Mn 75mg, Zn 45mg, Fe 20mg, Cu 5mg, Iodine 1.0mg, Se 0.01mg, Co 0.02mg, B.H.T. 90mg, ethoxyquin 33mg, Choline 150mg. GNC: Groundnut cake, UTBDG: Urea-Treated and fermented brewer's dried grains.*

Experimental Design and Management

A total of 195 Anak broiler chicks aged 35 days, were randomly allotted to five treatment groups, each with three replicates at 13 birds per replicate pen, in a Completely Randomized Design (CRD). The Finisher broiler chicks were managed on equal weight basis in rearing cages placed in an open-sided poultry house. The experimental finisher diets and water were provided *ad libitum* and necessary prophylaxis and vaccination were administered.

Measurements: Body weight development, body weight gain, feed intake and mortality were recorded on replicate basis weekly while feed conversion ratio was calculated according to Lambert *et al*. (1936). Economic analysis of broiler production was based on the cost of the diets as produced from the prevailing market price of the ingredients used at the time of purchased. This was used to compute the cost of feed consumed per kg weight gain for each diet, the cost differential and relative cost benefit values of the diets in relation to the control.

Chemical Analysis: The chemical analysis of the proximate compositions of the test ingredients (Table 2) and experimental diets (Table 1) were determined according to the procedure of AOAC (1990).

Statistical Analysis: Data obtained were subjected to analysis of variance and significant treatment means were compared by Duncan's Multiple Range Test (Duncan, 1955) using SPSS (10.0) package.

Results

The compositions of the finisher broilers diets are presented in Table 2. The proximate compositions of urea-treated and fermented BDG and the untreated BDG are presented in Table 3.

Table 3: Proximate Analysis of Test Ingredient (Urea-Treated and Fermented BDG)

Parameters (%)	Treated BDG	Untreated BDG
Dry matter	88.76	93.34
Crude Protein	38.52	24.21
Crude Fibre	4.49	11.20
Ether extract	4.87	3.69
Ash	5.99	8.04
Nitrogen free extract	34.89	46.20
Organic matter	82.77	85.30
Gross energy Kcal/g (Calculated	5.17	5.14

(Urea concentration used was 2%, 20g urea per litre of water)

The results of the performance parameters of finisher broilers fed graded levels of urea-treated and fermented BDG are presented in Table 4.

Table 4: Performance Characteristics of Finisher Broiler Fed Experimental Diets

	Dietary Treatments				
Replacement Levels (%)	100 GNC 00 UTBDG	75 GNC 25 UTBDG	50 GNC 50 UTBDG	25 GNC 75 UTBDG	00GNC 100 UTBDG
Mean Body weight(g)	2121.82 ± 25.59	2008.42 ± 61.17	1990.86 ± 15.07	1995.06 ± 61.08	1998.42 ± 74.98
Daily weight gain (g/bd)	79.28 ± 2.17	69.44 ± 8.70	56.83 ± 4.36	58.45 ± 9.61	66.04 ± 11.19
Feed intake (g/bd/d)	103.77 ± 2.46	104.99 ± 4.04	97.98 ± 2.26	102.78 ± 3.93	98.39 ± 2.76
Feed: Gain ratio	2.98 ± 0.44	3.15 ± 0.32	3.40 ± 0.23	3.33 ± 0.27	3.53 ± 0.35
Mortality (birds/treatment)	3	2	2	3	3

a, b, c means with different superscripts in the same row are significantly different (P < 0.05). UTBDG: Urea-treated and fermented brewer's dried grains GNC: Groundnut cake.

At the end of the finisher phase, the mean body weight, weight gain, feed intake and feed conversion ratio were not significantly (P > 0.05) different in all treatment groups. The results of the cost benefit analysis of the production of finisher broiler fed the experimental diets are presented in Table 5.

There were no significant (P > 0.05) differences in the total amount of feed consumed (Kg/bird) with increased levels of urea-treated and fermented BDG in the finisher diets. Cost of total feed consumed per bird significantly (P < 0.05) reduced as the levels of urea-treated and fermented BDG increased in the diets. The cost differential and relative cost-benefit per kilogram gain significantly (P > 0.05) increased with increasing levels of urea-treated and fermented BDG in the diets in all treatment groups.

Discussion

The similarities in the mean body weights, daily weight gains, feed intake and feed conversion ratio of finisher broilers in Table 3, is an indication that urea-treated and fermented BDG has nutritional qualities comparable to GNC in finisher diets. The similarity and impressive weight performance in all treatment groups shows that broilers at the finisher age were able to tolerate and efficiently utilize the different diets and this agrees with findings of Uchegbu and Udedibie (1998), Atteh and Opawande (2000), who found no significant differences in body weight performance when up to 75% untreated BDG replaced maize or GNC in finisher broiler diets. Singh (1988) also reported that growth might have been encouraged by high concentrations of essential fatty acids and unidentified growth factors contributed by brewer's dried grains in finisher diets. Isikwenu *et al.* (2008) stated that urea fermentation of BDG resulted in the breakdown and reduction of crude fibre and the release of locked up nutrients which encouraged a good performance of starter broiler chicks even when fed a diet with higher inclusion level of 16.70%. These may have aided the achievement of 100% replacement (26%) of the diet) of GNC with urea-treated and fermented BDG in finisher broiler diets in this study. The feed intake values showed that all diets were acceptable to finisher broiler birds as they ate approximately the same amount during the period. Feed conversion ratios of finisher broilers in all treatment groups were similar and indicate that growth rate and feed intake patterns of the birds at this age were not affected by the diets. It implies that the nutrient content of the different diets were adequate for biosynthesis of tissue for growth in addition to the ability of the finisher broilers to handle the fibre content of the diets (Uchegbu and Udedibie, 1998; Atteh and Opawande, 2000, Isikwenu *et al.,* 2010).

Table 5: Economic Analysis of Finisher Broiler Fed Experimental Diets

	Dietary Treatments				
Replacement Levels (%)	100 GNC 00 UTBDG	75 GNC 25 UTBDG	50 GNC 50 UTBDG	25 GNC 75 UTBDG	00GNC 100 UTBDG
<u>Parameters</u>					
Total feed consumed (Kg/bd)	2.58 ± 0.06	2.53 ± 0.02	2.41 ± 0.02	2.49 ± 0.01	2.45 ± 0.33
Cost of Total feed consumed/bd (₦)	105.21 ± 2.46[a]	100.19 ± 0.61[b]	92.54 ± 0.71[c]	92.95 ± 0.33[c]	88.47 ± 2.21[d]
Cost per Kg weight	66.36 ± 0.23[a]	66.49 ± 0.56[a]	62.28 ± 0.06[b]	62.20 ± 0.61[b]	60.44 ± 0.99[b]
Cost Differential per Kg gain (₦)	-	-0.13 ± 0.78[b]	4.08 ± 0.27[a]	4.16 ± 0.77[a]	5.92 ± 1.21[a]
Relative Cost Benefit per Kg gain (%)	100.00[b]	99.82 ± 1.17[b]	106.54 ± 0.44[a]	106.71 ± 1.29[a]	109.86 ± 2.16[a]

a, b, c, d means with different superscripts in the same row are significantly different (P < 0.05). Cost per Kg feed (₦) – Diet 1. ₦40.78; Diet 2. ₦39.60; Diet 3. ₦38.45; Diet 4. ₦37.28; Diet 5. ₦36.16. GNC: Groundnut cake. UTBDG: Urea-Treated and fermented brewer's dried grains.

This attests to the suitability of urea-treated and fermented BDG as a possible substitute for GNC in finisher broiler diets and that efficiency of feed utilization by broiler birds will not be adversely affected. The suitability is further confirmed by the very low and uniform record of mortality of 5.13% to 7.69% spread across all the treatment groups during experimentation. There was gain in financial margin in the production cost with the inclusion of urea-treated and fermented BDG as part replacement for GNC in finisher broilers diets. The cost of producing a Kg weight decreased from Naira 66.36 for the control to Naira 60.44 for 100% urea-treated and fermented BDG diet, representing 8.92% reduction in the cost of producing a Kg weight. The decrease in the cost of feed consumed per bird between the control diet of Naira 105.21 and that of 100% urea-treated and fermented BDG of Naira 88.47, represent a 15.91% reduction in the cost of producing a bird. This is an indication of a favourable cost analysis which could be interpreted to mean a positive response of finisher broilers to urea-treated and fermented BDG at the 100% replacement level. The cost differential and relative cost-benefit also showed a progressive gain per kg weight produced as urea-treated and fermented BDG replace GNC in finisher broiler diets. These are high and encouraging financial advantages when compared to the control.

Conclusion

Based on the comparable results obtained from weight performance, low mortality rate and reduced cost (8.92%) of production, the use of urea-treated and fermented BDG in finisher broiler diets in place of GNC is highly advocated. It was observed that urea-treated and fermented BDG can completely (100%) replace GNC (26% of the diet) as an alternative plant protein source in finisher broiler diets.

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