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REPLACEMENT VALUE OF BISCUIT DOUGH FOR MAIZE ON PERFORMANCE AND NUTRIENT UTILIZATION OF BROILER CHICKENS

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Abstract: This study was conducted for fifty-two days to investigate the effect of graded levels of biscuit dough (BD) on growth performance, nutrient utilization and carcass characteristics of broilers. A total of 144 day old broilers (Arbor-acre strain) were used for this study. They were completely randomized and divided into four treatment groups. Each group had three replicates of twelve birds per replicate. Four experimental diets were formulated such that control had maize and treatment 2, 3, and 4 had 5, 10, 15% inclusion of BD respectively at both starter and finisher phases. The responses of the broilers to dietary treatments were measured by feed intake (kg/bird), final weight (kg/bird), feed conversion ratio (FCR), carcass and organ characteristics and nutrients utilization. There were significant differences ($p<0.05$) across the treatments with treatment 3 and 4 (10 and 15%BD) having the highest values of 104.01 g/bird and 104.63 g/bird daily feed intake and treatment 1(T1) having the least value of 98.17 g/bird/day. For the final live weight, treatments 4, 5 had similar ($p>0.05$) weight gain (2.55 kg/bird) while treatment 1 had the least (2.25kg/bird). Addition of BD reduced the cost per kg weight gain by approximately 10% at 15% inclusion level. The nutrient digestibility were not significantly affected ($p>0.05$) across the treatments except the dry matter and nitrogen free extract digestibilities. The carcass weights expressed as a percentages of live weight (LW) were not significantly ($p>0.05$) affected except neck, wings and thigh. The relative organs weights showed that there were no significant ($p>0.05$) differences in the liver, gizzard, heart and spleen except kidney weights. It was concluded that biscuit dough can be used to replace 15% maize in broiler diets at both starter and finisher phases without negative effect on performance characteristics of broiler chickens.

Keywords: Biscuit dough, cost per weight gain, growth performance, carcass characteristics.

INTRODUCTION

The scarcity and escalating cost of unconventional feed ingredients have adversely affected the livestock production in Nigeria. In view of this, efforts have been geared towards search for the readily available alternatives (Arowora and Tewe, 2003). Some of these are brewer's dried grain (BDG), rice husk (RH), maize offal (MO), biscuit wastes (BW), pineapple waste (PW), palm kernel meal (PKM), sorghum spent grains (SSG) among others. Nigeria is

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blessed with vast range of feed resources such as grains, oilseeds which by-products could be used in the formulation of feed. This locally available feed resources in Nigeria have potential to support a flourishing livestock industry, but are grossly under-utilized thus resulting in a reduced livestock production.

Nutritionist and animal feed producers will choose alternative feed ingredients if the quality and prices are competitive. This has drawn the attention of farmers to the competitive quality of biscuit waste compared to maize in the diet of monogastricanimal sequel to the recommendation Longe (1987) and Adeyemo *et al*., (2013). Bakery waste has been used as nonconventional ingredient in the diet of animals on the basis of economic and environmental advantages and apart from the common biscuit waste there is biscuit dough (BD): an agro industrial waste product found in substantial quantities in biscuit producing industries located at different industrial areas.BD is a palatable, high energy feed produced from wheat flour, skimmed milk powder, vegetable fat, sugar, and salt and flavor materials. Biscuit dough is made up of biscuit components that fail the first time biscuit quality and are yet to undergone baking. The cost of biscuit dough is relatively cheap compared with maize because it is considered a waste product from the bakery. The use of biscuit dough as replacement for maize has potential to reduce the competition between man and animal for convectional feed sources. Although there is information on the potential of biscuit waste as a good ingredient in monogastric animal, there is paucity of information on the potential of biscuit dough.

MATERIALS AND METHODS

Experimental Site: The experiment was carried out at the Broiler Production Unit of Ladoke Akintola University of Technology Teaching and Research Farm, Ogbomoso, Oyo State in the derived savanna zone of Nigeria.

Procurement and processing of Test Ingredients: Biscuit dough (BD) was obtained from bakery, Ibadan, Oyo State, Nigeria. This test ingredient (biscuit dough) was in pasty form from the factory. It was sun dried on drying floor with turning at interval to a moisture content of between 10-12%. The sun dried biscuit dough was milled into BD meal and mixed with other feed ingredients to formulate experimental diets.

Formulation of Experimental Diets: Four experimental diets were formulated at both the starter and finisher phases. The compounded diets were in mash form (Tables 1). The diets were formulated to meet the nutrient requirements for broilers according to recommendation (NRC, 1994).

Table 1: Gross composition of broiler finisher diets (g/100gDM)

INGREDIENTS (%)	T1(0%BD)	T2(5%BD)	T3(10%BD)	T4(15%BD)
Maize	60.30	55.30	50.30	45.30
**BD	-	5.00	10.00	15.00
*Fixed ingredients	39.70	39.70	39.70	39.70
Total	**100.00**	**100.00**	**100.00**	**100.00**
Calculated Nutrients				
Feed cost/Kg	90.11	88.36	86.61	84.86
Crude protein (%)	19.13	19.04	19.55	20.07
Metabolizable energy (Kcal /kg)	2848.70	2817.20	2785.70	2754.20
Crude fibre (%)	3.45	3.56	3.67	3.77

**BD=Biscuit Dough, *Fixed ingredients= soybeean:21, wheat offal: 11.5, fish:3,oyster shell:1.5, DCP:2, salt: 0.5, methionine:0.1, lysine: 0.1, vit. Premix: 0.25

EXPERIMENTAL BIRDS AND MANAGEMENT

A total of 144 day old (Arbor-acre strain) broiler chicks was used for the experiment. Birds were allocated to four dietary treatments with each treatment having three replicates in a completely randomized design. Each replicates had 12 birds to make a total of 36 birds per treatment. The chicks were reared on a deep litter system and offered feed and water *ad-libitum.* Wood shavings were used as litter materials. The feed offers as well as orts were weighed on daily basis while the birds were weighed on weekly basis throughout the weeks of experiment. Drugs and vaccinations were done in accordance with the prevailing vaccination and medication schedule for broiler in the experimental area. The experiment lasted for fifty-two days.

DATA COLLECTION

Data were collected on feed intake, weight gain was calculated from weekly weight changes while feed to gain ratio was calculated as average feed intake divided by average weight gain. Feather weights were determine by weight different between bled weight and defeathered weight. At the end of the experiment, 9 birds (three birds per replicate) were randomly selected from each treatment and were starved overnight for 12 hours but allowed access to water *ad libitum*. The birds were sacrificed by severing the jugular veins. Various organs were removed and weighed while carcasses were later cut into prima cuts and weighed using sensitive scale. The weights of cut parts were expressed as the percentages of live weight of the birds.

Nutrient Utilization: At the 8th week of the experimental period, three birds were selected per replicate and transferred to metabolic cages for digestibility trial. The birds were housed

separately in individual cages with facility for feeding, drinking and faecal collection. Weighed feed was given to the birds for 7 days and faeces were collected separately daily for each bird during the last 3days. The collected faecal samples were sun dried, ground and pooled together per bird and sub sample was taken for determination of proximate composition according to AOAC (2005). All data generated were subjected to one way analysis of variance (ANOVA) using SAS (2000) package. Means were separated using Duncan's Multiple Range Test option of the same package.

RESULTS AND DISCUSSION

Table 2: Proximate composition and metabolizable energy of Biscuit Dough

Parameters (%)	Biscuit Dough
Dry matter	90.04
Crude protein	19.25
Ether extract	3.64
Ash	7.06
Crude fibre	4.16
Nitrogen free extract	65.89
Metabolizable energy (MJ/kg)	11.71

Table 3: Performance of broiler chickens fed graded levels of Biscuit Dough (BD)

Parameters	T1(0%BD)	T2(5%BD)	T3(10%BD)	T4(15%BD)	SEM
Initial weight/bird (g)	40.36	40.67	40.33	40.69	-
Final live weight (kg/bird)	2.25^{b}	2.46^{ab}	2.55^{a}	2.55^{a}	0.05
Daily weight gain (g/bird)	40.76	44.79	43.80	45.10	0.91
Daily feed intake (g/bird)	98.17^{b}	100.64^{ab}	104.01^{a}	104.63^{a}	0.97
Feed conversion ratio	2.43	2.25	2.38	2.32	0.05
Feather weight(g)	626.67^{b}	796.67^{ab}	903.33^{ab}	907.00^{a}	51.82
Feed cost/Kg (₦)	88.37^{a}	85.52^{b}	83.77^{ab}	79.77^{b}	1.14
Feed cost/kg wt gain (₦)	212.07^{a}	192.42^{c}	199.37^{b}	185.06^{d}	3.04

[a,b,c] Means along the same row with different superscript(s) are significantly different ($p<0.05$).SEM: Standard error of means, BD: Biscuit dough.

Table 4: Nutrient digestibility of broiler chickens fed graded levels of biscuit dough (BD)

Parameters	0%BD)	5%BD	10%BD	15%BD	SEM
Dry matter Digestibility	81.33^{a}	79.33^{ab}	79.92^{ab}	77.37^{b}	0.61
Crude protein Digestibility	88.54	86.89	87.41	85.70	0.67
Crude Fibre Digestibility	64.72	58.49	63.35	57.69	1.97
Ether extract Digestibility	97.29	96.71	97.48	97.21	0.19
Ash Digestibility	90.65	90.09	90.91	88.46	0.65
NFE Digestibility	71.76^{a}	68.20^{ab}	67.67^{ab}	65.00^{b}	0.95

[a,b] Means along the same row with different superscript(s) are significantly different ($p<0.05$). SEM: Standard error of means, BD: Biscuit dough. NFE: Nitrogen Free Extract

Table 5: Carcass characteristics of broiler chickens fed varying levels of biscuit dough

Parameters	T1(0%BD)	T2(5%BD)	T3 (10%BD)	T4(15%BD)	SEM
LW/bird (g)	2250[b]	2460[ab]	2550[a]	2550[a]	48.68
BW/bird (kg)	2.09	2.10	2.12	2.01	0.30
EW/bird (kg)	1.71	1.77	1.74	1.66	0.29
Carcass weight (g)	1495.00	1523.33	1516.67	1445.00	0.27
Dressing percentage	60.44	61.92	59.48	59.67	1.02
Relative weight of primal cut (% of live weight)					
Head	2.31	2.07	2.02	1.97	0.07
Neck	4.45[a]	3.69[ab]	4.03[ab]	3.58[b]	0.13
Breast	20.30	19.41	18.44	17.27	0.58
Back	13.09	11.82	11.20	10.95	0.37
Wing	8.26[a]	7.45[ab]	6.86[ab]	6.79[b]	0.21
Thigh	10.95[a]	9.82[ab]	9.61[ab]	9.23[b]	0.27
Drumstick	10.25	9.89	8.95	8.72	0.27
Shank	3.68	3.56	3.13	3.33	0.12

[a,b] Means along the same row with different superscript(s) are significantly different (P<0.05). SEM: Standard error of means, BD: Biscuit dough, LW: Live Weight, BW: Bled Weight, EW: Eviscerated Weight.

Table 6: Relative organ weights of broiler chickens fed varying levels of biscuit dough

Parameters	T1(0%BD)	T2(5%BD)	T3(10%BD)	T4(15%BD)	SEM
Kidney	0.42[a]	0.35[b]	0.31[ab]	0.35[b]	0.01
Liver	2.65	2.30	2.64	2.36	0.08
Gizzard	2.79	2.51	2.54	2.33	0.08
Heart	0.50	0.42	0.48	0.42	0.01
Spleen	0.07	0.61	0.06	0.09	0.01

[a,b] Means along the same row with different superscript(s) are significantly different (P<0.05). SEM: Standard error of means, BD: Biscuit dough.

The proximate composition of biscuit dough (Table 2) obtained was greater than that of biscuit waste as reported by Adeyemo *et al*. (2013), Longe (1987), Ajasin *et al*. (2010) except the value of ether extract. The gross energy of biscuit dough (11.71MJ/kg) was higher than (3.20MJ/kg) that of biscuit waste as reported by Adeyemo *et al*. (2013). Also crude protein

value of 19.25%CP was higher compared to 10.8% CP by Longe (1987) while Ajasin *et al*. (2010) recorded 9.56% CP. The variations may be because biscuit dough has not been exposed to heat through baking. Heat processing according to Eugene *et al*. (2008) generally decreased dry matter, crude protein, ash, crude fat, total carbohydrate and calorific values.

Table 3 shows the growth performance of experimental birds. The pattern of weight gain indicates a higher utilization of biscuit dough (BD) containing diet compared with control diet. Dietary treatment had no significant effect on all parameters except average daily feed intake (g/bird) and average final live weight (Kg/bird). The similarities among all treatments in the feed conversion ratio (FCR) imply that the biscuit dough-based diets compared favourably with control. The average daily feed intake were similar compared with the control except diets T3 and T4 which were significantly higher than other two treatments, this might be as a result of taste and smell of the biscuit dough. This was contrary to the report of Peter and Abel (2006) that smell and taste have lower effect on feed intake. The powdery nature of BD seems to haste the uniform consumption of each component of feed ingredients, this was contrary to the report of Adeyemo *et al*. (2013) when biscuit waste was included in the diet of broilers. Treatments 2, 3 and 4 had similar live weight. Treatment 4 was significantly ($p<0.05$) higher when compare to control diet. The highest weight recorded by the birds on treatment T4 (15% BD) could be as a result of the high feed intake. The productivity of poultry is ultimately governed by the bird's daily feed intake because unless the bird eats to expectation, productivity will suffer (Steven, 2011). The results of these study did not agree with the report of Longe (1998) that there were no significant different ($p>0.05$) across the treatment of birds fed varied inclusion levels of biscuit waste, thus revealing the superior quality of BD compared over biscuit waste in the diet of broiler chicken.

The result of the cost analysis showed that it will cost more to produce broiler on diet one (Control diet) than diet T4. Addition of biscuit dough reduced the cost per unit weight gain by 3.63, 5.21 and 9.73% for 5, 10 and 15% inclusion levels of biscuit dough respectively. This is an indication of economic benefit of biscuit dough when incorporated in the diet of broilers. It has been stated by Hossain *et al*. (2003) that poultry production may not be remunerative if costly conventional feeds cannot be replaced by the cheaper unconventional feeds in the diets. Poultry production represent the most vertical, integrated, rapidly growing and highly globalized animal production industry (Thobela, 2003), hence reduced cost of feed ingredients will improve production by resource poor farmers and impact significantly on the will to purchase poultry meat and eggs by consumers (Thobela, 2014).

It is also of interest that feather weight increase with increase inclusion level of BD. This might be as a result of good nutrients derived from the BD. This agreed with the report of Kazok (2011) and Fuller and Wilcke, (1942), that nutrition plays important role in the development of feather. Feather weight increase with increase body weight of this experimental birds and this was also in line with the report of Kazok (2011) that body weight significantly influences the quantity of feather. Lack of feather development is of considerable economic important, particularly in the broiler industry where the occurrence of "bareback" presents a serious problem (Fuller and Wilcke, 1942).

Table 4 shows the nutrient digestibility of broilers fed varied inclusion levels of biscuit dough (BD). Biscuit dough inclusion in the diets of broilers up to a level of 15% had no significant ($p>0.05$) effect on the digestibilities of crude protein, crude fibre, ether extract and ash except the dry matter and nitrogen free extract digestibilities. Dry matter and nitrogen free extract digestibilities decreased with increasing inclusion levels of BD. The Control diet recorded the highest values 81.33% (dry matter digestibility) and 71.76% (nitrogen free extract digestibility).From this study, the reason of non-significant difference of nutrient utilization may be that dietary inclusion of biscuit dough did not significantly affect the activity of digestive enzyme and intestinal integrity.

Table 5 shows the carcass characteristics of broilers fed graded level of biscuit dough. The dressed weight usually expressed as dressing percentage is an indication of value of meat that could be obtained from the animal. The study shows that dressing percentage of the broilers which ranged from 59.48 to 61.92% were not significantly ($P>0.05$) different from each other. There were no significant differences ($p>0.05$) in bled weight, eviscerated weight, carcass weight, head, breast, back, drumstick and shank, indicating that the muscle turnover were not affected by the different dietary inclusion of BD and this is in line with the findings of Akpodiete *et al.* (2004). Significant differences ($p<0.05$) were observed in wing, thigh and neck weight of the birds. The birds on control diet (0% Biscuit Dough) had significantly ($p<0.05$) higher values of 4.45, 8.26 and 10.95 respectively for wing, thigh, and neck relative weights.

The result of relative organs weight of broiler chickens fed varied inclusion levels of biscuit dough (BD) is presented in Table 6. There was no significant difference in all the organ of broiler chickens measured except the relative weights of kidney. It is a common practice in feeding trials to use the weights of some internal organs like liver and kidney as indicators of

toxicity. Ahamefule *et al*. (2006) reported that if there are toxic elements in the feed, abnormalities in weights of liver and kidney would be observed. The abnormalities will arise because of increased metabolic rate of the organs in an attempt to reduce these toxic elements or anti-nutritional factors to nontoxic metabolites. The decreased kidney weight of the birds with the varied inclusion levels of biscuit dough therefore was a reflection of reduced extra muscular activity of the kidney when compared to the birds on control diet. This corroborate the report of Adeyemo *et al.* (2013) that biscuit waste has no anti-nutritional factor and could make a good replacement for maize and other cereal grains in feeding broilers, snail, and fattening ram for market or for slaughter.

Conclusions: Inedible cheaper bakery by products, biscuit dough (BD), could replace costly maize of conventional diet up to 15% for the formulation of economic broiler ration. The use of biscuit dough in the diet may improve broiler performance and profitability. Also the level of inclusion of BD in the diet may be up to 15%.

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