



Growth Performance and Carcass Characteristics of Broiler Finisher Fed Different Cereal Grain By-Products

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Abstract

An experiment was conducted to evaluate the performance of broiler finisher chickens fed different cereal grain by-products. Five experimental diets were formulated to contain MO, SO, WO, MIO and BDG at 15% levels of inclusion represented as T1, T2, T3, T4 and T5. One hundred and fifty Amor broiler chickens were randomly allotted to five dietary treatment groups in a completely randomized designed. Each treatment was replicated three times with ten birds per replicate. Result obtained showed that feed intake was not significantly ($p > 0.05$) different among treatment groups except weight gain and feed conversion ratio. T1 (1315.44g/birds) and T2 (1279.60g/birds) had the higher values and T5 (1142.96) recorded the lowest. Live weight and carcass yield showed no significant ($p > 0.05$) different except dressing percentage. T1 (69.51) had the highest value while T3 (62.73) and T5 (61.31) recorded the lowest. Based on the study, it can be concluded that cereal grain by-product can be included into the broiler finisher chickens diets at 15% level without deleterious effect on growth performance and carcass yield as it gave a promising result.

Keywords: Cereal grain by-product, Broiler chickens, Growth performance, Carcass evaluation.

Introduction

In Nigeria, the problem of inadequate grain, oil seed cakes and seed meal has contributed to the gap between animal need and supply in the country. Livestock industry has been crippled because of the high cost of feed which constitute largely of conventional feed materials/stuff. Meat has become an unaffordable luxury in many developing countries such as Nigeria. This necessitates the use of nonconventional feed ingredients as they offer the best alternative to over dependence on conventional feed sources (Dafwang *et al.*, 2001). Feeding poultry with alternative feed like cereal grain by-products that are locally obtained and readily

available at an affordable cost with no detrimental effects on poultry is very important because of high cost and competition with the conventional grains. Alawa *et al.* (1990) have advocated the development of alternative feeding materials that will be relatively cheap when compared with commercial feeds or conventional feedstuffs. The high cost of conventional feeds and feedstuffs brought about the need to have alternative feedstuffs that can replace the expensive ones to reduce the cost of livestock production (Longe, 1987). The use of unconventional feed ingredients in compounding poultry feed in order to reduce cost of production is well documented in

literature (Duru, 2010). Non- conventional feedstuffs offer the best alternatives in our environment for reducing feed cost and therefore reduction in the cost of meat and animal products (Dwafwang *etal.*, 2001). Utilization of fibre sources have been reported to increase carcass yield and laid down tissues (internal organs) of birds (Iheukwamereet *al.*, 2008). It also has laxative action in the gut and because of their high fibre content, can be used as nutrient diluents for monogastric animals. Thus, processing waste is relatively available in both rural and urban communities in Nigeria and exploring their nutritional potential as feedstuff for livestock continue to be the focus of animal nutritionist in order to reduce feeding cost (Ojebiyet *al.*, 2009). Much research work on the use of cereal grain by-product for non-ruminant animal feeding have concentrated on growth and inclusion levels. There is dearth of information on the utilization of Maize offal, Sorghum offal, Wheat offal, Millet offal and Brewers dried grains agro by-products in broiler chickens production. This study was therefore designed to compare the utilization of these cereal grain by-products in broiler finisher chicken.

Materials and Methods

Experimental site

The experiment was conducted at Gombe State Ministry of Agriculture in the Poultry Production Unit (PPU) between March and May 2015. Gombe state is located between latitude 9°30' to 12°30' North and longitude 8°45' to 11°45' East with an altitude of 540m above sea level. The state has mean maximum monthly temperature of 37°C, minimum of 12°C and relative humidity of 94% in August and 10% in December. Rain falls from April to October which ranges

between 970.7 mm to 1,142 mm annually, with a mean of 1,009.4 mm. Vegetation of the area is savannah grassland (Gombe State Government, 2009). Climatic and adaphic factors favour crop and livestock agriculture.

Sources of the Ingredients

Different cereal grain by-products; maize offal, sorghum offal and millet milling waste were sourced locally around Gombe and its environs, particularly grains milling shops where the products is found in large quantities, while Brewers dried grain also from Gombe locally made beer areas and wheat offal together with Maize, Soya beans, Fish meal, Bone meal, Salts, Premix, Methionine and Lysine were obtained from Gombe State market, Nigeria. The offal were not subjected to any form of processing.

Experimental Birds and their Management

A total of one hundred and fifty (150) unsexed strains of Amor broiler finisher weight ranges (712.91-821.07g/birds) at five weeks of age were used for the experiment. Before their arrival room was thoroughly swept, washed with detergent and then disinfected with IZAL[®] so as to eliminate disease causing organism present that may be a source of infection to the broilers. After three days when the room was dried, wood shavings was spread on the cemented floor to a depth of about six centimeters (6cm) to serve as an insulator and also absorbed moisture from droppings. A vaccine against Newcastle and Gumboro Diseases were administered to maintain them in a good health. All vaccines were administered in clean drinking water and proper sanitation was maintained by regular cleaning of

feeding and watering trough, depends on the extent needed during the experimental period. They were fed experimental broiler finisher diets throughout the period which lasted for 28 days.

Experimental Diets and Design

Five experimental diets were formulated using maize offal, sorghum offal, wheat

offal, millet offal, brewers dried grains and subjected to proximate analysis for T1, T2, T3, T4 and T5 respectively (Tables 1 and 2). The birds were randomly weighed and allotted to five (5) dietary treatment groups of 30 birds each and replicated three times with 10 birds per replicate in a Completely Randomized Design.

Table 1: Ingredients Composition and Calculated Analysis of Experimental Diets

Ingredient	<i>Dietary Treatments</i>				
	T1 (MO)	T2(SO)	T3(WO)	T4(MIO)	T5(BDG)
Maize	48.77	43.43	51.27	49.20	56.77
Soybean	30.43	35.77	27.93	29.93	22.43
Maize offal	15				
Sorghum offal		15			
Wheat offal			15		
Millet offal				15	
Brewer dried grain					15
Fishmeal	2	2	2	2	2
Bonemeal	3	3	3	3	3
Premix	0.25	0.25	0.25	0.25	0.25
Methionine	0.20	0.20	0.20	0.20	0.20
Lysine	0.10	0.10	0.10	0.10	0.10
Salt	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100
Calculated Analysis					
Crude protein	20.00	20.30	20.00	20.00	20.00
Crude fibre	4.52	3.89	4.31	3.51	4.51
Ether extracts	7.85	9.09	8.01	8.12	7.58
Calcium	1.08	1.08	1.08	1.08	1.08
Phosphorus	0.50	0.50	0.50	0.50	0.50
ME (Kcal/kg)	3019.33	3026.26	3068.93	3029.74	3010.84

*Vitamin-Mineral premix; (Bio-mix) provided per Kg the following: Vitamin A500iu Vitamin D₃,888000iu; Vitamin E, 12,000mg; Vitamin K₃, 15,000mg; Vitamin B₁, 1000mg; B₂, 2000mg; Vitamin B₆, 1500mg; Niacin, 1200mg; Pantothenic acid, 2000mg; Biotin, 1000mg; Vitamin B₁₂, 3000mg; Folic acid1500mg; Choline Chloride; 60,000mg, Manganese, 10,000mg Iron, 1500mg; Zinc, 800mg; Copper 400mg; Iodine, 80mg; Cobalt 40mg; Selenium, 8000mg.

Table 2: Proximate Composition of Broiler Experimental Diets

Parameters	Dietary Treatments				
	T1 (MO)	T2(SO)	T3(WO)	T4(MIO)	T5(BDG)
Dry matter	96.43	95.47	96.09	94.90	96.01
Crude protein	20.01	20.16	20.10	20.31	20.11
Crude fibre	13.11	12.86	14.12	12.81	14.11
Ether extracts	6.12	6.73	6.50	6.50	6.00
Ash	7.31	8.71	9.11	8.80	9.11
NFE	53.45	51.54	50.17	51.58	50.67
*ME (Kcal/kg)	3138.47	3126.10	3056.44	3114.26	3033.66

*ME (Kcal/kg) = $37 \times \% \text{CP} + 81.8 \times \% \text{EE} + 35.5 \times \% \text{NFE}$ (Pauzenga, 1985), NFE = Nitrogen Free Extract, MO = Maize offal, SO= Sorghum offal, WO= Wheat offal, MIO = Millet offal, BDG = Brewers dried grain, NFE = Nitrogen free extract.

Data Collection: Data were collected on the following parameters during the period of the experiment.

Chemical Analysis: Data for the experimental diets were analysed using standard analytical methods of AOAC (1990) to determine dry matter (DM), crude protein (CP), crude fibre (CF), ether extract (EE), whereas nitrogen free extract (NFE) and metabolizable energy (ME) were calculated using the formula of Pauzenga (1985). $\text{ME (Kcal/kg)} = 37 \times \% \text{CP} + 81.8 \times \% \text{EE} + 35.5 \times \% \text{NFE}$

Average daily feed intake: Feed given to the birds were weighed daily in each treatment and its replication. The leftover were also collected and weighed every morning before feeding. Daily record of feed supply and feed consumption per bird was obtained by dividing the total feed consumed by number of live birds. This is mathematically represented as:

$$\text{Average feed consumed} = \frac{\text{Total feed consumed (g/bird)}}{\text{No. of live bird}}$$

Average daily weight gain: Birds were weighed weekly to observe body weight changes with the use of a weighing balance. The weight was recorded and body weight gain was calculated by subtracting initial weight from final weight. Average daily weight gain = Final weight - Initial weight (g/bird)

Feed conversion ratio: Feed conversion ratio was obtained by dividing the average feed intake per live bird/day by the daily weight gain of the bird:

$$\text{Average feed consumed} = \frac{\text{Feed intake (g)}}{\text{Weight gain (g)}}$$

Carcass Yield and Internal Organs

Characteristics: At the end of four weeks, six birds were randomly selected from each treatment group (i.e. two from each replicate within the treatment) and fasted overnight to remove intestinal content thereby emptying the crop and minimizing residual ingesta, but water offered. The following morning before slaughter, the selected birds were weighed to obtain their live body weight, individually slaughtered using knife by cutting the jugular vein and allowed to completely bled, cervical dislocation as described by (Oluyemi and

Roberts, 2000). Immersed in hot water (60°C) for three (3) minutes to facilitate defeathering, weight to obtain plucked weigh and eviscerated to determine the eviscerated weight. Head and shank were removed to determine carcass and internal organs weighed which were expressed as a percentage proportion of live weight to obtain the dressing percentage as follows:

$$\text{Average feed consumed} = \frac{\text{Carcass weight}}{\text{Live weight}}$$

Statistical analysis: All data generated were subjected to one way analysis of variance (ANOVA) using SPSS version 20, means were further separated using Duncan Multiple Range (1955) Test of the same software.

Results and Discussion

Proximate Composition of Experimental Diets

The proximate composition of the experimental diets for the growing period is presented in Table 2. Dry matter (DM) contents ranged from 94.90 – 96.43% which shows similar trends in all the diets. Crude protein values range from 20.01 to 20.31% CP. These values agreed with the report of (Oluyemi and Robert, 2000; Saskatchewan, 2000; Jack dish, 2008 and Olomu, 2011) who recommended 20% CP level for broiler finisher in order to support optimum performance in the tropics. The crude fibre for the finisher diets ranged from 12.81 to 14.12%. The values are higher than 8-10% recommended for broiler finisher by Saskatchewan, (2000). Crude fibre content in the diets of broiler chickens facilitates passage of intestinal digester (McDonald *et al.*, 1998). Either extract were ranged from 6.0 to 6.12%. They were within the recommended range of 5 to 7% NRC (1996) in broiler diets. The Ash content was ranged

from 7.31 to 9.11% whereas NFE recorded values of 50.17 to 53.45%. These variations agree with the observations of Chiou *et al.* (1994) who reported that, different sources of fibre having different chemical and physical composition influenced differently the utilization of nutrients. The metabolizable energy (ME) values of the experimental diets were ranged from 3056.44 to 3154.55 kcal/kg. These values fall within the range of 2950 to 3300 kcal/kg as recommended by Jansen (2000) for broilers starter and finisher phase respectively, while on the other hand Oluyemi and Robert (2000) recommended 3200 (ME, kcal/kg) for both starter and finisher phases. These values can support the growth of broiler chickens at both phases. However, it is in contrast with the report of Aduku (1992) who recommended 2800 to 3000 kcal/kg, Olomu (1995) 2800 to 3000 kcal/kg and NRC (1994) 3200 to 3300 (ME, kcal/kg) for starter and finisher phases. Although, the energy need of broiler chickens cannot be stated as precisely as the need for protein, amino-acids, minerals and vitamins since broiler chickens increases their feed intake at the expenses of lower energy diets.

Growth Performance of Broiler Finisher Fed Different Cereal grain by-Product

The results of growth performance at finisher phase are shown in Table 3. Average daily feed intake of broiler chickens fed different cereal grain by-products indicated that, there were no significant ($P > 0.05$) difference among the treatment means. It could be due to the gut filled effect, gritty nature of the feed across the different dietary treatment and probably due to the facts that

bird on higher fibre diet consumed more water than feed as observed during the

Table 3: Performance of Broiler Finisher Fed Different Agro-Industrial By-Products

Parameters (g)	Dietary Treatments					SEM
	T1 (MO)	T2(SO)	T3(WO)	T4(MIO)	T5(BDG)	
Initial weight	821.07 ^a	800.23 ^a	718.68 ^b	766.51 ^{ab}	712.91 ^b	1.75*
Final weight	2136.51 ^a	2079.83 ^{ab}	1914.84 ^{bc}	2025.95 ^{abc}	1855.87 ^c	19.95*
ADFI	114.96	115.20	119.80	117.62	121.81	5.28 ^{NS}
ADWG	46.98 ^a	45.70 ^a	42.72 ^b	44.98 ^{ab}	40.82 ^b	1.35*
TWG	1315.44 ^a	1279.60 ^a	1196.16 ^{ab}	1259.44 ^{ab}	1142.96 ^b	14.64*
FCR	2.45 ^c	2.52 ^{bc}	2.80 ^{ab}	2.61 ^{bc}	2.98 ^a	0.11*
Mortality (%)	1	0	2	1	1	

a,b,c = means with different superscripts on the same row are significantly different * = Significant ($p < 0.05$), NS = Not significant, SEM = Standard Error of Means, ADFI = Average daily feed intake, ADWG = Average daily weight gain, TWG = Total, weight gain, FCR = Feed conversion ratio, MO = Maize offal, SO = Sorghum offal, WO = Wheat offal, MIO = Millet offal, BDG = Brewers dried grains

experiment. This observation is in agreement with the statement of Ezieshi and Olomu (2003; 2004) who's reported more water consumption when birds offered fibre diets. The range of values 114.96 to 121.81g/day/bird obtained were below the range of 141.28 to 158.45g/bird/day observed by Igwebuike *et al.* (2001) and Nsa *et al.* (2009). The lower feed intake in this study, compare to the other findings were attributed to the differences in the energy diets of the experimental feed as the higher energy range (3010.84 to 3019.33ME Kcal/kg) were formulated in this study. Sunde (1984) also observed that feed consumption decreases when the energy content of the diets increases. The average daily weight gain of broiler chickens at finisher phase shows significant ($p < 0.05$) different that cut across the treatment means. T1 (46.98g/bird) and T2 (45.70g/bird) having higher value while T5 (40.82g/bird) and T3 (42.72g/bird) recorded lower value. The range of values (40.82g/bird to 46.98g/bird) are in consistent with the report of Okah and Onwujiariri (2010) but

contradicts the findings of Grace *et al.* (2007) who obtained lower weight gain. The higher weight gain recorded in this study compared to the other findings tended to the higher energy diets (3019.33-3010.80 ME kcal/kg) offered during the experiment but fall within recommended range of 3200 ME/kcal (Oluyemi and Robert, 2000) for finisher diet. Significant variation in weight gain within the treatment groups mean there exists some level of superiority. This could be attributed to the diverse nutrient within the treatment groups associated with the metabolizable energy, mineral, protein and relative fibre content of the diets. However, the lower weight gain obtained in T3 (42.72g/bird) and T5 (40.82g/bird) could be attributed to the higher level of fibre that often dilute nutrient and impairs absorption and assimilation Agbabiaka (2012). FCR shows significant ($p < 0.05$) different across all the dietary treatments. Superior value of 2.45 was recorded in T1 (MO) while inferior value of 2.98 was observed in T5 (BDG). The mean ranges of 2.45 to 2.98 are within the recommended range of 1.8 – 3.2 reported

by Olomu (1995) for better FCR at finisher phase. Variations across different dietary fibre may have to do with alteration in texture, colour, taste and odour of the diets Nir *et al.* (1994). Feed consumption and ultimately utilisation may be affected by each of the above factors independently or in combination Odunsi *et al.* (1996). This could

probably account for the reason T1 (MO) gave superior FCR compared to T5 (BDG) which is in support to the statement of Ikurior and Achadu (1995) that BDG is not easily converted by chickens because of its high fibre content and low digestibility of its CP and low energy content.

Table 4: Carcass and Internal Organs Characteristics of Broiler Chickens Fed Different Cereal Grain by-Products

Parameters	Dietary Treatments					SEM
	T1(MO)	T2(SO)	T3(WO)	T4(MIO)	T5(BDG)	
Live weight (g)	2129.84	2016.59	1889.68	1998.81	1796.73	172.22 ^{NS}
Slaughter weight (g)	2059.73	1949.37	1829.47	1932.93	1736.72	165.53 ^{NS}
Plucked weight (g)	2018.77	1899.36	1778.50	1882.72	1676.72	160.14 ^{NS}
Eviscerated weight (g)	1717.66	1585.36	1457.48	1563.17	1351.60	132.92 ^{NS}
Carcass weight (g)	1480.43	1339.85	1185.36	1298.04	1101.63	123.26 ^{NS}
Dressing % (D%)	69.51 ^a	66.44 ^b	62.73 ^c	64.94 ^b	61.31 ^c	0.79 [*]
Head weight (g)	2.04	2.06	2.09	1.93	2.30	0.17 ^{NS}
Leg weight (g)	3.70	3.82	3.58	4.04	4.24	0.55 ^{NS}
Internal organs weight (% live weight)						
Liver	1.89	1.99	2.14	2.02	2.40	0.16 ^{NS}
Heart	0.34	0.35	0.38	0.37	0.40	0.15 ^{NS}
Lungs	0.47	0.42	0.44	0.49	0.52	0.18 ^{NS}
Kidney	0.02	0.02	0.02	0.02	0.02	0.00 ^{NS}
Pancreas	0.19	0.22	0.25	0.25	0.27	0.108 ^{NS}
Gizzard	1.87 ^b	1.85 ^b	2.49 ^{ab}	2.06 ^{ab}	2.94 ^a	0.16 [*]
Abdominal fat	2.11	2.01	1.88	1.91	1.91	0.57 ^{NS}
Small intestine	2.20	2.15	2.16	2.28	2.28	46.34 ^{NS}
Large Intestine	0.11 ^b	0.13 ^b	0.19 ^a	0.13 ^b	0.21 ^a	0.02 [*]
Caecal	0.38	0.36	0.51	0.37	0.54	0.45 ^{NS}
Small intestine length(cm)	194.33	183.33	187.00	193.00	182.00	8.80 ^{NS}
Large intestine length (cm)	10.73	10.50	11.90	10.77	11.47	0.88 ^{NS}
Caecal length (cm)	18.33	18.33	19.33	18.50	18.50	18.50 ^{NS}

a,b,c means with different superscripts on the same row are significantly different * = Significant (p<0.05), NS = Not significant, SEM = Standard Error of Means, MO = Maize offal, SO = Sorghum offal, WO = Wheat offal, MIO = Millet offal, BDG = Brewers dried grains

Carcass Weight and Internal Organs Characteristics of Broiler Chickens Fed Different Cereal Grain by-products

The result of carcass analysis is shown in Table 4. There were no significant (p>0.05) different among treatment means except for the dressing percentage. This is in consistent

with the findings of Amaefule *et al.* (2011) who reported significant ($p < 0.05$) difference in percent dressed weight of broiler finisher chickens fed cereal grain by-products. The non-significant ($p > 0.05$) difference observed in other parameters could be attributed to the starvation period adopted prior to the slaughtering. This is in support with the findings of Northcut (2000) who stated that after broiler birds have been without feed for more than 6 hours, they began to absorb moisture and nutrient from their own body tissue and this weight loss may then affect edible yield. The pattern of differences in dressed weight was nearly similar with the daily weight gain and final body weight. Value range of 61.31 to 69.51% obtained in this study is in conformity with the means value reported by Ojewola *et al.* (2006) when such cereal grain by-products were fed to broiler chickens. The observed higher dressed carcass weight of broiler fed T1 (MO) when compare with others, is considered a direct consequence of better final body weight and FCR. This is also in line with the optimum range of 65 – 70% reported by Oluyemi and Robert (2000). He further made a statement that higher mean live weight resulted from higher dressing percentage, though dressing percentage is a function of carcass weight and live weight of the bird.

The internal organs weight which were expressed as a percentage of live body weight shows significant ($p < 0.05$) difference in gizzard and large intestinal weight but insignificant ($p > 0.05$) difference were observed in liver, heart, lungs, kidney, pancreas, abdominal fat, small intestine weight and length, caecal weight and length and large intestine length. The differences observed in gizzard weight indicated that

more work have been done to blend the fibre ingested Onifade (1993). Similar reports were obtained when high fibre feed stuffs such as spend grains, sesame seed and tiger nut meals were fed to broiler finisher (Obidinma, 2009; Ndubuisi and Okorie, 2010; Agbabiaka *et al.*, 2012) respectively. A significant variation revealed in large intestinal weight indicated the effect of arabinoxylans which constitute the bulk of hemicelluloses in rice bran and offals Erbingeroova *et al.* (1994). Similar observations were reported that diet high in roughage increase the size of gastro intestinal track in other species of animals (Rompala and Madsen, 1989). Non significant ($p > 0.05$) differences in the organ weights investigated describe non toxicity or abnormalities in the organ system and therefore, safe for use in broiler feed production. The means value of organ weight observed in this study are in consonance with the findings of Akpodiete *et al.* (1997) and Fanimio *et al.* (2005) who observed no gross morphological manifestation in the organs of the birds fed cereal by-products.

Conclusion

Based on the study, it can be concluded that cereal grain by-product contain moderate amount of nutrient that can be included in to the broiler finisher diets at 15% level without deleterious effect on growth performance and carcass yield as its gave promising result.

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