International Journal of Animal Science and Technology
2022; 6(3): 71-77
http://www.sciencepublishinggroup.com/j/ijast
doi: 10.11648/j.ijast.20220603.14
ISSN: 2640-1282 (Print); ISSN: 2640-1312 (Online)

Growth Performance and Carcass Characteristics of Broiler Chickens Fed Diets Containing Graded Levels of Brewer's Dried Grains with Enzyme and Yeast Supplementation

Akintunde Afolabi Rotimi[1, *], Daniel Bala[2], Oguntoye Mutiu Ayogbe[1], Akinsola Oludayo Michael[3], Adeoye Samson Olubode Babalola[4], Isaac Samuel[5], Ardo Bashir Aisha[1], Istifanus Emmanuel Filian[6]

[1]Department of Animal Science, Taraba State University, Jalingo, Nigeria

[2]Department of Animal Production and Health, Federal University, Wukari, Nigeria

[3]Department of Veterinary Theriogenology and Production, Faculty of Veterinary Medicine, University of Jos, Jos, Nigeria

[4]Department of Animal Physiology, Federal University of Agriculture, Abeokuta, Nigeria

[5]Department of Agricultural Science Education, Federal College of Education (Technical) Bichi, Asaba, Nigeria

[6]Department of Animal Science, University of Uyo, Uyo, Nigeria

Email address:

fola_akintunde@yahoo.com (Akintunde Afolabi Rotimi)

[*]Corresponding author

To cite this article:

Akintunde Afolabi Rotimi, Daniel Bala, Oguntoye Mutiu Ayogbe, Akinsola Oludayo Michael, Adeoye Samson Olubode Babalola, Isaac Samuel, Ardo Bashir Aisha, Istifanus Emmanuel Filian. Growth Performance and Carcass Characteristics of Broiler Chickens Fed Diets Containing Graded Levels of Brewer's Dried Grains with Enzyme and Yeast Supplementation. *International Journal of Animal Science and Technology*. Vol. 6, No. 3, 2022, pp. 71-77. doi: 10.11648/j.ijast.20220603.14

Received: February 24, 2022; **Accepted**: March 31, 2022; **Published**: September 29, 2022

Abstract: Eight weeks feeding trial was carried out using a total of one hundred and forty seven day old broiler chicks to assess the growth performance and carcass characteristics of broiler chickens fed diets containing graded levels of brewer's dried grains supplemented with enzyme and yeast. Seven experimental diets (T1, T2, T3, T4, T5, T6 and T7) were formulated using brewers dried grain at three different dietary inclusion levels of 5%, 10%, and 15%. Diet 1 was the basal diet (control) designated as T1, Diets 2, 3 and 4 consisted of 5, 10 and 15% BDG as replacement for maize supplemented with 200mg/100kg enzyme designated as T2, T3 and T4 while diets 5, 6, 7 consisted 5, 10 and 15% BDG as replacement for maize supplemented with 200mg/100kg yeast designated as T5, T6 and T7 respectively. The diets were formulated for starter phase (1-4 weeks) and finisher phase (5-8 weeks) respectively. At the starter phase, the results revealed the final weight, total weight gain, daily weight gain and feed conversion ratio were significantly influenced by BDG based diets supplemented with phytase enzyme and yeast. Birds on diet T4 (15%) had significantly ($P < 0.05$) higher final weight, total weight and daily weight gain (724.60, 567.38 and 27.02g) respectively with enzyme supplementation compared to birds on diets containing 5% BDG supplemented with 200mg yeast. However, feed intake differed non-significantly ($P > 0.05$) across all the treatment groups. Birds fed diet T1 recorded the least feed conversion ratio (2.36) and was significantly ($P < 0.05$) better compared to those of other treatments. At finisher phase, birds on diet T5 (5%) supplemented with yeast recorded higher values (1613.89, 861.34 and 30.76g) for final weight, total weight and daily weight gain and these were comparable to other dietary treatments except diet T7. However, no significant ($P > 0.05$) difference was observed in the feed intake of birds across the treatments. Birds fed diets T1 and T5 had the least feed conversion ratio (4.36, 4.35) respectively and these were significantly ($P < 0.05$) better compared to those of other treatments. There was significant ($P < 0.05$) effect of dietary treatments observed on mortality (%). The percent live weight, plucked weight, eviscerated weight, dressed weight, neck weight, shank, head weight, liver weight and kidney weight were significantly ($P < 0.05$) affected by dietary treatments. It was therefore concluded that inclusion of BDG supplemented with enzyme or yeast as replacement for maize in broiler diets improved performance and carcass characteristics.

Keywords: Brewer's Dried Grains, Enzyme, Yeast, Growth Performance, Carcass Characteristics, Broiler Chicken

1. Introduction

Poultry plays a vital role in poverty alleviation and requires less land and financial investment, free from religious taboo and economic constraints which affects the commercial production of livestock. They are characterized by low capital requirement and quick returns [22, 23]. It has been observed that poultry products (meat and egg) offer considerable potential for bridging the gap of animal protein needed in the diets of a human being [7].

Cereal grains especially maize has been for long used as conventional energy source in broiler production. This is simply because maize served as the basis on which other grains are compared [1]. Due to ever escalating cost of maize, there has been an increased competition for its usage and its inadequate production to meet the needs of man and his livestock made it critical to look inward and consider the use of non- conventional feedstuffs [6]. The by-products of our local varieties of cereal like sorghum and millet which are relatively cheap and locally available can favourably compete with maize in broiler diets [14].

Brewers dried grains (BDG), a by-product of the beer industry might offer a suitable cheap substitute for maize. It can be incorporated in breeder ration without adverse effect on performance. It is used as a source of energy and contains other essential nutrients which are required in feed formulation for poultry. BDG was reported to contain over 20% crude protein, about 6% ether extract, over 15% crude fibre and about 4% ash [4]. BDG needs to be dried before incorporation in poultry rations and when not properly dried, it will cause fermentation which will reduce nutritive value of the products.

BDG has high fibre content, poor nutritive value and unsuitability for direct animal use [8]. There is need therefore for BDG to be supplemented with additives (Yeast and Enzyme). Yeast and Enzyme has been long used to increase broiler's growth rate, and control diseases [3]. They are performance enhancer through improvement in nutrients of poultry feeds. Yeast is considered as one of the living micro-organism that when administered through digestive tract had positive impact on broiler health through nutritional effect [25]. It also boosts immune level resulting in a better protection against infection [24]. Yeast and Enzyme also improves nutrients digestibility and feed efficiencies in corn-based diets [5, 29].

Agro-by-products are noted for high fibre content which is a major problem for their efficient use in monogastric animal nutrition. Monogastric animals such as pigs and poultry have low capability of handling cellulose, hemicelluloses and lignin which form the major components of agro-industrial products. However, efforts are being made to hydrolyze these structural carbohydrates and protein so as to make their active ingredients available in monogastric animal nutrition. This study therefore was aimed at assessing growth performance and carcass characteristics of broiler chickens fed diets containing graded levels of brewers dried grains supplemented with enzyme and yeast.

2. Materials and Methods

2.1. Experimental Site

The research was carried out at the Poultry Unit of the Teaching and Research Farm, Taraba State University, Jalingo; It lies between latitude 8°50 N and longitudes 11°31 E Situated in the Northern Guinea Savannah zone with an annual rainfall range of 1000 mm to 1500 mm, the ambient temperature of the area ranges between 38°C - 41°C. The rain season being at its peak in June and September. The dry season is between November and March with the harmatan wind blowing from the north east Sahara and Sahel region [28].

2.2. Test Ingredients and Preparation

Brewers Dried Grains (BDG) was collected fresh from producer of local drink (*burukutu*) at Jalingo. It was spread in a polythene sheets and sun-dried for 3 days to avoid fermentation which could reduce the nutritive value of the products. It was packed inside polythene bag and kept in cool dried place till the period of compounding the experimental diets.

2.3. Experimental Diets

Seven experimental diets (T1, T2, T3, T4, T5, T6 and T7) were formulated using brewer's dried grains at three different dietary inclusion levels of 5%, 10%, and 15% based on the standard requirement of broiler birds [21]. Diet 1 was the basal diet (control) designated as T1, Diets 2, 3 and 4 consisted of 5, 10 and 15% BDG in replacement of maize supplemented with 200mg/100kg phytase enzyme designated as T2, T3 and T4 while diets 5, 6, 7 consisted of 5, 10 and 15% BDG in replacement of maize supplemented with 200mg/100kg yeast designated as T5, T6 and T7 respectively. The diets were formulated for starter phase (1-4 weeks) and finisher phase (5-8 weeks) as presented in Tables 1 and 2 below.

2.4. Experimental Birds, Design and Management

A total of one hundred and forty seven (147) day-old broiler chicks were purchased from a commercial hatchery in Jos. The birds were weighed at the commencement of the experiment, and were randomly divided into seven treatment groups of 21 birds each. Each treatment group was replicated three times in a Completely Randomized Design of 7 birds per replicate. The birds were raised for 8 weeks in two phases; starter phase (1-4 weeks) and finisher phase (5-8 weeks). During the experiment, feed and clean water were provided *ad libitum* while routine vaccination, medication and management practices were strictly followed.

Table 1. *Composition of a Starter Broiler Chickens Diets Containing Graded Levels of Brewers Dried Grains Supplemented with Phytase Enzyme and Yeast (1-4 weeks).*

Ingredients	T1 Control	Enzyme (200mg)			Yeast (200mg)		
		T2	T3	T4	T5	T6	T7
		5%	10%	15%	5%	10%	15%
Maize	50.00	47.50	45.00	42.50	47.50	45.00	42.50
BDG	0.00	2.50	5.00	7.50	2.50	5.00	7.50
Soya beans (FFS)	21.00	21.00	21.00	21.00	21.00	21.00	21.00
G N C	16.60	16.60	16.60	16.60	16.60	16.60	16.60
Fish meal	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Rice offal	5.05	5.05	5.05	5.05	5.05	5.05	5.05
Bone meal	3.50	3.50	3.50	3.50	3.50	3.50	3.50
Lysine	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Methionine	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Salt/NaCl	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Vitamins premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Calculated Analysis							
Metabolizable energy (kcal/kg)	2923.65	2901.23	2878.80	2856.38	2901.23	2878.80	2856.38
Crude protein (%)	22.67	23.12	23.57	23.90	23.12	23.57	23.90
E E (%)	4.30	4.31	4.33	4.35	4.31	4.33	4.35
Crude fiber (%)	3.64	3.88	4.12	4.36	3.88	4.12	4.36
Calcium (%)	1.12	1.13	1.13	1.14	1.13	1.13	1.14
Phosphorus (%)	0.66	0.66	0.67	0,67	0.66	0.67	0,67
Lysine (%)	1.17	1.19	1.20	1,22	1.19	1.20	1,22
Methionine (%)	0.61	0.62	0.63	0.64	0.62	0.63	0.64

*Biomix premix provided per kg of diet: Vit A. 1334i.u, Vit D_3 2,680 i.u, Vit E 10 i.u; Vit K 2.68mg; Calcium Pantothenete, 10.68mg; Vit B1 0.022MG; Folic aci 0.668mg; Choline chloride, 400mg, Chlortetracycline, 26.68mg; Manganese 133.34mg; Iron, 66.68mg; Zinc, 55.34mg, Copper, 3.2mg; Iodine, 1.86; Cobalt, 0.268mg, Selenium 0.108mg. GNC = Ground Nut Cake, BDG = Brewer Dried Grain, EE = Ether Extract.

Table 2. *Composition of a Finisher Broiler Chickens Diets Containing Graded Levels of Brewers Dried Grain Supplemented with Phytase Enzyme and Yeast (5-8 weeks).*

Ingredients	T1 Control	Enzyme (200mg)			Yeast (200mg)		
		T2	T3	T4	T5	T6	T7
		5%	10%	15%	5%	10%	15%
Maize	61.00	57.95	54.90	51.85	57.95	54.90	51.85
BDG	0.00	3.05	6.10	9.15	3.05	6.10	9.15
Soya beans (FFS)	16.10	16.10	16.10	16.10	16.10	16.10	16.10
GNC	12.00	12.00	12.00	12.00	12.00	12.00	12.00
Fish meal	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Rice offal	5.05	5.05	5.05	5.05	5.05	5.05	5.05
Bone meal	3.00	3.00	3.00	3.00	3.00	3.00	.00
Lysine	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Methionine	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Salt/NaCl	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Vitamins premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Calculated analysis							
Metabolizable energy (kcal/kg)	3,002.29	2,974.89	2,947.53	2,920.17	2,974.89	2,947.53	2,920.17
Crude protein (%)	19.20	19.74	20.29	20.84	19.74	20.29	20.84
Ether Extract (%)	6.50	6.60	6.71	6.81	6.60	6.71	6.81
Crude fiber (%)	3.35	3.64	3.94	4.23	3.64	3.94	4.23
Calcium (%)	0.93	0.94	0.95	0.96	0.94	0.95	0.96
Phosphorus (%)	0.56	0.57	0.58	0.59	0.57	0.58	0.59
Lysine (%)	0.96	0.98	1.00	1.02	0.98	1.00	1.02
Methionine (%)	0.56	0.57	0.58	0.60	0.57	0.58	0.60

*Biomix premix provided per kg of diet: Vit A. 13. 34i.u, Vit D_3 2,680 i.u, Vit E 10 i.u; Vit K 2.68mg; Calcium Pantothenete, 10. 68mg; Vit B1 0.022MG; Folic aci 0.668mg; Choline chloride, 400mg, Chlortetracycline, 26.68mg; Manganese 133.34mg; Iron, 66.68mg; Zinc, 55.34mg, Copper, 3.2mg; Iodine, 1.86; Cobalt 0.268mg. Selenium 0.108mg. GNC = Ground Nut Cake, BDG = Brewer Dried Grain.

2.5. Data Collection

2.5.1. Growth Performance

The initial weights of the birds were taken on arrival, final weight, total and daily weight gain, and feed conversion ratio was measured. Average weekly feed intake was obtained by subtracting the quantity of feed left-over from quantity of feed supplied to the birds per week. Weekly body weight gains were measured by subtracting the body weight of the bird in the preceding week from body weight of the following week. Feed conversion ratio (FCR) was obtained by dividing the average feed intake per bird per week by the weight gain per bird per week. Mortality (%) was also recorded as they occurred.

2.5.2. Carcass Evaluation

At the end of the 8th weeks of feeding trial, one bird per replicate was randomly selected from each pen based on the average weight of the group for carcass evaluation. The birds were fasted overnight prior to slaughtering, and slaughtered by severing the jugular veins while allowing the blood to drain thoroughly before being scalded in warm water. Thereafter, they were de-feathered and eviscerated. Organs and cut parts were removed, weighed and expressed as percentage of live weight. Primal cuts measured were percentage thigh, breast, back, drum stick, wing, head, neck and shank. While the organ weights measured were percentage liver, gizzard, heart, spleen, lungs, kidney and intestine.

Formulae

$$Feed\ intake/bird\ (g) = \frac{Quantity\ of\ feed\ fed - Quantity\ of\ feed\ left\ over}{Number\ of\ birds}$$

$$Daily\ weight\ gain\ (g) = \frac{final\ live\ weight - initial\ weight}{Number\ of\ birds}$$

$$Feed\ conversion\ ratio = \frac{Quantity\ of\ feed\ consumed}{Weight\ gain}$$

2.6. Statistical Analysis

All data collected in this study were subjected to analysis of variance using the SPSS software [26]. Significant differences among treatment means were separated using Duncan's New Multiple Range Test (DNMRT) [26].

3. Results and Discussion

Growth Performance of Broiler Chickens Fed Diets Containing Graded Levels of Brewers Dried Grain (BDG) Supplemented with Phytase Enzyme and Yeast is presented in Table 3.

Table 3. *Growth Performance of Broiler Chickens Fed Diets Containing Graded Levels of BDG Supplemented with Phytase Enzyme and Yeast (1-8 weeks).*

Parameters	T1 Control	Enzyme (200mg)			Yeast (200mg)			SEM
		T2	T3	T4	T5	T6	T7	
		5%	10%	15%	5%	10%	15%	
Starter (1-4 weeks)								
Initial weight (g)	157.21	157.22	157.18	157.22	157.23	157.21	157.21	0.00
Final weight (g)	703.33^{ab}	692.07^{ab}	680.16^{ab}	724.60^{a}	657.94^{b}	678.57^{ab}	676.19^{ab}	9.63
Total weight gain (g)	546.12^{ab}	534.85^{ab}	522.97^{ab}	567.38^{a}	500.71^{b}	521.36^{ab}	518.98^{ab}	9.63
Daily weight gain (g)	26.00^{ab}	25.47^{ab}	24.90^{ab}	27.02^{a}	23.84^{b}	24.83^{ab}	24.71^{b}	1.18
Total feed intake (g/b/d)	1290.9	1419.0	1313.5	1377.0	1417.5	1365.1	1337.3	24.24
Daily feed intake (g/b/d)	61.47	67.57	62.55	65.57	67.5	65.00	63.68	1.15
FCR	2.36^{b}	2.65^{ab}	2.51^{ab}	2.43^{ab}	2.83^{a}	2.62^{ab}	2.58^{ab}	0.05
Finisher (5-8 weeks)								
Initial weight (g)	752.53	752.54	752.54	752.55	752.55	752.55	752.55	0.01
Final weight (g)	1588.89^{a}	1507.78^{ab}	1461.11^{ab}	1515.88^{ab}	1613.89^{a}	1486.11^{ab}	1427.78^{b}	21.58
Total weight gain (g)	836.36^{ab}	755.23^{ab}	708.57^{ab}	763.33^{ab}	861.34^{a}	733.57^{ab}	675.23^{b}	21.58
Daily weight gain (g)	29.87^{ab}	26.97^{ab}	25.30^{ab}	27.26^{ab}	30.76^{a}	26.20^{ab}	24.11^{b}	0.77
Total feed intake (g/b/d)	3644.5	3730.8	3755.6	3590.5	3750.6	3729.4	3911.8	47.40
Daily feed intake (g/b/d)	130.16	133.24	134.12	128.23	133.95	133.19	139.70	1.69
FCR	4.36^{b}	4.94^{ab}	5.30^{ab}	4.70^{ab}	4.35^{b}	5.08^{ab}	5.79^{a}	0.17
Mortality (%)	4.76^{b}	10.32^{a}	4.76^{b}	0.00^{b}	5.56^{b}	0.00^{b}	10.32^{a}	1.62

^{ab} Mean in the same row with different superscripts are significantly different (P<0.05), SEM= Standard Error of Mean.

The results of growth performance characteristics of starter and finisher broiler chickens fed diets containing graded levels of brewers dried grain (BDG) supplemented with phytase enzyme and yeast are presented in Table 3. At starter phase, final weight (g), total weight gain (g), daily weight gain (g), and feed conversion ratio (FCR) were significantly influenced by BDG supplemented with enzyme or yeast. Birds fed diet T4 (15% BDG with enzyme supplementation) had significantly (P<0.05) higher final weight (724.60g) compared to the least value 657.94 obtained in diet T5 (5%

BDG with yeast supplementation). The final weights values of birds in other treatment groups were statistically similar (P<0.05). Total weight gain and daily weight gain (567.38 and 27.02g) respectively of birds on diet T4 were significantly (P<0.05) higher and these were comparable to those in other dietary treatments except diet T5 which had the least values ((500.71 and 23.84g). The least (P<0.05) value of 2.36 was recorded for feed conversion ratio of birds fed the control diet and this was significantly (P<0.05) better compared to those other treatments. This could be attributed to improved rate of utilization of the dietary nutrients and conversion to gains. This observation agrees with the findings of [11] who reported that better feed conversion ratio signified that more feed was retained in the animals and less waste to the environment. However, no significant (P>0.05) effect of dietary treatments was observed on total and daily feed intake of birds. The non-significant (P>0.05) effect of dietary treatments observed in the total feed intake, and daily feed intake of birds could be due to the acceptability and palatability of the diet across all the treatments. This result agrees with the report of [20] that smell and taste were critical traits in food selection. No mortality was recorded across all the dietary treatments.

At finisher phase, the significantly (P<0.05) higher values (1613.89, 861.34 and 30.76g) for final weight, total weight and daily weight gain obtained in birds fed 5% BDG supplemented with yeast (T5) were comparable to other dietary treatments except those on diet T7. [16] observed significant improvement in final body weight, daily body weight gain and feed conversion ratio in broiler finisher chickens fed BDG replacing up to 50% maize. This could be attributed to good nutrients utilization as enhanced by yeast supplementation. This also agrees with the findings of [19] who reported that brewer dried grain and yeast are worthy to be considered as potential non-conventional feed for broiler chickens as this improved performance. However, [27] also reported that birds fed ration supplemented with yeast consumed more feed, grew faster, and had better body weight gain than birds fed without yeast. The non-significant (P>0.05) effect of dietary treatments observed in the total feed intake, and daily feed intake of birds could be due to the acceptability and palatability of the diet across all the treatments. This result agrees with the report of [20] that smell and taste were critical traits in food selection. Mortality (%) was significantly (P<0.05) affected across all the treatments. Birds fed diets T2 and T7 were statistically similar (10.32%) and higher than those in other treatments. This could indicate that the dietary treatments had negative effect on the health status of the bird.

Carcass Characteristics of Broiler Finisher Chickens Fed Diets Containing Graded Levels of BDG Supplemented with Phytase Enzyme and Yeast.

Table 4. *Effect of Diets Containing Graded Levels of BDG Supplemented with Phytase Enzyme and Yeast on Carcass Characteristics of Broiler Finisher Chickens (5 – 8 weeks).*

Parameters	T1 Control	Enzyme (200mg)			Yeast (200mg)			SEM
		T2	T3	T4	T5	T6	T7	
		5%	10%	15%	5%	10%	15%	
Live weight (g)	1688.89^{a}	1507.78^{ab}	1461.11^{ab}	1515.88^{ab}	1613.89^{a}	1486.11^{ab}	1427.78^{b}	21.58
Plucked weight (g)	1619.00^{a}	1211.67^{b}	1434.67^{ab}	1522.67^{a}	1412.00^{ab}	1397.00^{ab}	1413.33^{ab}	33.69
Eviscerated weight (g)	1395.67^{a}	1029.33^{c}	1214.33^{abc}	1317.67^{ab}	1197.33^{abc}	1180.33^{bc}	1218.67^{abc}	30.95
Dressed weight (g)	1158.00^{a}	801.67^{c}	962.33^{bc}	1037.33^{ab}	955.67^{bc}	920.67^{bc}	893.67^{bc}	29.37
Dressing percentage (%)	77.49	77.52	77.55	77.88	77.61	77.64	77.67	0.01
Major cuts and organs expressed as percentage of live weight (%)								
Wing (%)	9.21	7.62	8.29	8.98	8.51	8.33	8.28	0.22
Thigh (%)	14.38	9.91	12.32	12.25	13.21	11.96	13.42	0.46
Breast (%)	22.13	16.02	19.72	23.32	19.41	16.21	19.19	0.82
Back (%)	14.89	12.37	15.09	14.02	14.39	12.63	14.99	0.44
Neck (%)	5.93^{ab}	4.20^{b}	5.75^{ab}	6.21^{a}	4.45^{ab}	4.75^{ab}	5.80^{ab}	0.21
Shank (%)	5.29^{a}	4.32^{b}	5.04^{ab}	5.25^{a}	4.53^{ab}	5.06^{ab}	5.19^{ab}	0.10
Head (%)	2.99^{ab}	2.88^{ab}	3.08^{ab}	3.38^{a}	2.64^{b}	3.16^{ab}	3.22^{a}	0.06
Drum stick (%)	11.81	8.43	11.51	11.10	11.59	10.15	11.90	0.38
Gizzard (%)	2.96	2.31	2.81	2.45	2.22	2.74	2.85	0.08
Liver (%)	2.11^{a}	1.81^{ab}	1.94^{ab}	1.86^{ab}	1.31^{b}	1.54^{ab}	1.77^{ab}	0.07
Lungs (%)	0.55	0.68	0.94	0.57	0.57	0.70	0.84	0.05
Kidney (%)	0.46^{b}	0.42^{b}	0.97^{a}	0.59^{b}	0.64^{ab}	0.63^{ab}	0.78^{ab}	0.05
Heart (%)	0.38	0.45	0.50	0.81	0.45	0.54	0.61	0.05
Intestine (%)	5.31	4.89	6.89	7.12	5.50	6.78	7.17	0.38

^{abc} Mean in the same row with different superscripts are significantly different (P<0.05), SEM= Standard Error of Mean.

Table 4 presents the effect of diets containing graded levels of BDG supplemented with phytase enzyme and yeast on carcass characteristics of broiler finisher chickens. Live weight (g), plucked weight (g), eviscerated weight (g), dressed weight (g), neck weight (%), shank (%), head weight (%), liver weight (%), kidney weight (%) were significantly (P<0.05) affected by different dietary levels. This may be attributed to better feed utilization. [10] reported that carcass quality is closely related to dietary nutrients quality. However, no significant (P>0.05) effect of dietary treatments were observed among parameters such as dressing percentage (%), wing (%), thigh (%), breast%, back%,

drumstick %, gizzard %, lungs (%), heart (%) and intestine (%) across all the treatments indicates balanced nutrients utilization by birds. Lack of significant (P>0.05) differences observed in the percent lungs, heart and intestine of birds across the treatments showed that diets supplemented with yeast and enzyme had no negative effect on the organ weight of the birds. This agrees with the findings of [9] who observed no significant difference in gizzard weight in broiler chickens fed different levels of Maize Sorghum Brewers Dried Grain at 15-30% level.

4. Conclusion and Recommendations

4.1. Conclusion

1) BDG with phytase enzyme (200mg/100kg) supplementation or yeast at 15 and 5% inclusion levels respectively had a positive effect on growth performance of broiler chickens both at starter and finisher phases respectively.
2) Inclusion of BDG supplemented with phytase enzyme (200mg/100kg) at 15 and 5% inclusion levels had a significant effect on carcass characteristics of broiler chickens.

4.2. Recommendations

1) BDG with enzyme (200mg/100kg) supplementation or yeast at 15 and 5% inclusion levels had a positive effect on growth performance and carcass characteristics of broiler chickens.
2) Farmers should adopt the use of BDG supplemented with phytase enzyme or yeast at 15 and 5% inclusion levels in poultry diets for improved performance and without negative effect on the health status of birds.

References

[1] Atteh, J. O. (2002). Principle and Practice of Livestock Feed Manufacturing. *Adlek Printers, Ilorin, Nigeria*, pp: 13-17.

[2] Banerjee, G. C. (1998). A textbook of Animal Husbandry. Oxford & IBH Publishers 8th edition of forth and *IBH Publishing Co PVT. Ltd New Delhi,* 132-139Pp.

[3] Chen, K. L., Kho, W. L., Tou, S. H., Yeh, R. H., Tang, S. W. and Hsieh, C. W. (2009). Effect of *Bacillus subtilis*var. *natto* and *Saccharomyces cerevisiae* mixed fermented feed on the enhanced growth performance of broilers. *Poultry Science*, 88: 309-315.

[4] Couch, J. R. (1978). Brewers dried grains in poultry feed. Poultry International, July, 42.

[5] Cowieson, A. J. and Ravindran, V. (2008). Effect of exogenous enzyme in maize based diet varying in nutrient density for young broilers: Growth performance and digestibility of energy, mineral and amino acids. *British poultry science*. 49: 37-44.

[6] Egbunike, G. N. and Achiobong, I. O. (2002). Performance and serum chemistry of growth: Stimulated broiler finisher cassava peel based diet. *Proceeding of the 7th Annual Conference of the Animal Science* of Nigeria, September 16-19, 2002, Nigeria, pp: 44-46.

[7] Ekenyem, B. U. and Madubuike, F. N. (2006). An assessment of ipomoea sarifolia leaf meal as feed ingredient in broiler chick production. *Pakistan Journal of Nutrition*. 5: 46-50.

[8] El Hag, B. G. and Kurdi, O. I. (1986). Prospect of efficient Utilisation of Agro-industrial by-products and crop residues for ruminant feeding in the sudan, with emphasis on quantification, nutritional composition, constraints and research results. In. T. R. Preston and M. Y. Nuwanyakpa (eds), Towards optimal feeding of Agricultural by-products to livestock in Africa. *Proceedings of workshop held at Alexandria, Egypt, October 1985. ILCA, Addis Ababa.* Pp. 22-23.

[9] Esonu, B. O., Anumni P., Obinna, K., Eneremadu, O. F. (1999). Evaluations of combinations of Maize/Sorghum based brewer's grains, cocoyam corm and cassava root meals as substitute for maize in broiler finisher diets. *Indian Journal of Animal Science* 69: 129-130.

[10] Fetuga, B. L., Babatunde, G. M. and Oyenuga, V. A. (1975). Protein quality of some Nigerian food stuffs. *Ibadan University press, Ibadan*, pp. 1505-1514.

[11] Gebhart, C. L. and Kabanov, A. V. (2001). Evaluation of polyplexes as gene transfer agents. *Journal of Controlled Release*, 73 (2): 401-416.

[12] Gous and Morris (2005). Comparison of raw, washed and polished Quinoa (*chenopodium quinoa* wild.) of wheat, sorghum or maize based diets on growth and survival of broiler Checks. Livestock research Rural Development 13 (1). Retrieved may 16, 2007 from *http:www.cipar.org.colriid13/IIimpr13.html.*

[13] Gous, W. and Gualtieri, G. (1998). Textbook of west African Agriculture, 2nd Edition. Janssen WM. MA (ed.) (1989). European Table of energy values poultry feedstuffs. 3rd ed. Beckbergen, Netherland: *Spelderholt center for poultry Research and Information Service*.

[14] Ibitoye, E. B., Olorede, B. R., Jimoh, A. A. and Abubakar, H. (2012). Comparative performance and organ relative weight of broiler chickens fed three sources of energy diet. *Journal of Animal Production.* Adv., 2: 233-238.

[15] Ikwelle, M. (1999). Director Keynotes. Annual review and planning workshop of the *national root crop research institute, Umudike, Abia State, Nigeria*. February, 1999.

[16] Ironkwe, M. O. and Bamgbose, A. M. (2011). Effect of replacing maize with brewers' dried grain in broiler finisher diet. *International Journal of Poultry Science* 10: 710712.

[17] Kalmenda, G. (2011). Effect of feeding raw or constituted high tannin red sorghum on Nutrient utilization and ce ain welfare parameters of broiler chicks. *Britian poultry Science* 48 (2) 198-204.

[18] Khalili, A., Tabeidian, S. A., Toghyani, M., Ghalamkari, G., Bahrami, Y. (2011). Effect of different levels of brewer's dried grains and enzyme on performance, protein digestibility, immune response and performance of broiler. *International Journal of Academic Research* 3: 1153-1157.

[19] Munthali, J. T. K, Jere, C. H., Cusack, T. J. (1989). An evaluation of alternative feeds for intensive egg production in Malawi. Lilongwe, Malawi: Chitedze Agricultural Research Station. Technical Paper.

[20] Nidaullah, H., Durrani, F. R., Ahmad, S., Jan, I. U. and Gul, S. (2010). Aqueous extract from different medicinal plants as anticoccidial, growth promotive and immune stimulant in broilers. *Journal of Agricultural and Biological Science,* 5 (1) 53-59.

[21] N. R. C. 1994. Nutritional Research Council Nutrient Requirement of Poultry 9thedn. Revised edition National Academic of Science. Washington D. C.

[22] Obioha, F. C. 1992. A Guide to poultry production in the tropics, 1st edn, Accia Publishers, Nigeria. Pp. 47-79.

[23] Onwukwe, C. C. (2006). The effect of lema beans (*Phaeolus luntus*) cooked with potash (Akawu) on broiler finisher diet. *B.Sc. Thesis. Michael Okpaara University of Agriculture, Umudike, pp:* 6-25.

[24] Panda, A. K., Reddy, S. V., Rama Rao, M. V., Raju, L. N. and Paraharaj, N. K. (2000). Growth, carcass characteristics, immune-componence and response to *Escherichia coli* of broiler fed diets with various level of probiotic, *Archive fur Geflugelkunde* 64: 152-156.

[25] Patterson, J. A. and Burkholder, K. M. (2003). *Science* Application of prebiotics and probiotics in poultry production *International Journal of Poultry*, 82: pg. 627-631.

[26] SPSS (2012). Statistical Package for social sciences, version 21. USA IBM Corporation.

[27] Talebi, A., Amerzadeh, B., Mokhtari, B. and Gahri, H. (2008). Effect of multistrain probiotic (primalac) on performance and antibody response to New Castle diseases, virus vaccination in broiler chickens, *Avian Pathology* 37 (5): 509-512.

[28] Taraba State Diary, (2008). Ministry of Information, Jalingo, Taraba State, Nigeria.

[29] Tang, D., Hao, S., Liu, G., Nian, F. and Ru, Y. (2014). Effects of maize source and complex emzymes on performance and nutrient utilization of broilers. *Asian-Australia Journal Animal Science 27: 1755*-1762.