



## Effects of Dietary Levels of Brewers' Dried Grain Supplemented with Commercial Enzymes on Performance, Nutrient Retention and Gastro-intestinal Tract Characteristics of Arbor Acres Broilers

**O. O. Alabi**

Department of Animal  
Science, Landmark University,  
Omu-Aran, Nigeria

**J. O. Atteh**

Department of Animal  
Production, University of  
Ilorin, Ilorin, Nigeria

**I. O. Adejumo**

Department of Animal  
Science, Landmark University,  
Omu-Aran, Nigeria

**O. O. Ogundele**

Department of Agricultural  
Science, College of Education,  
Ilorin, Ilorin, Nigeria

**Abstract** – This experiment was carried out to investigate the effect of dietary inclusion of brewer's dried grain (BDG) supplemented with commercial enzyme on performance, nutrient retention and gastro-intestinal tract characteristics of Arbor acres broilers. The experimental design was a 2×4 factorial combination of two dietary levels of brewers' dried grain (0 or 25%) with four levels of different commercial enzymes 0E (without enzyme 0ppm), 100E (100ppm of Roxazyme G), 150E (150ppm of Nutrase xyla) or 350E (350ppm of Grindazyme). BDG was added at the expense of maize in the control diet, and each experimental diet was tested during a 56day feeding trial in triplicate. One hundred and ninety-two (192) one-day old unsexed Arbor acres chicks were used in the trial. Experimental diet and water were supplied ad-libitum to the birds from the first day to day 56 and the birds were subjected to the recommended routine vaccination programmed. A nutrient digestibility trial was undertaken when the birds were 3 weeks old. At the end of the feeding trial, 3 birds per replicate were randomly selected, euthanized by neck decapitation, then eviscerated, and the crop, proventriculus, gizzard, liver and pancreas weights were determined. The results showed that an increase in the dietary level of BDG without commercial enzyme supplementation significant decrease ( $p<0.05$ ) weight gain, feed conversion ratio and nutrient digestibility. There were significant ( $p<0.05$ ) interaction between dietary levels of brewers' dried grain and commercial enzyme on performance, nutrient digestibility and gastro-intestinal tract characteristics of chicks. Hypertrophy of the digestive organs was observed in the birds fed brewers' dried grain without enzyme supplementation. However, this effect was attenuated with the inclusion of commercial enzymes. Results obtained showed that birds fed brewers' dried grain supplemented with commercial enzymes performed better in all parameters tested than those fed brewers' dried grain diets without commercial enzyme. The use of commercial enzyme is advantageous in the utilization of high-fibre diets for chicks. The dietary supplementation with commercial enzymes increased the weight gain feed conversion ratio and improved nutrient digestibility in broilers, which supposes a beneficial reduction in the production cost.

**Keywords** – Brewer's Dried Grain, Broiler, Commercial Enzyme, Feeding Trial, Organ.

### I. INTRODUCTION

Large quantities of grains are used in the brewing of beer and also in the distilling of liquors. The extracted residue resulting from the manufacture of wort or beer is termed Brewer's Wet Grain (BWG). If the residue is dried

it is termed Brewers' Dried Grain (BDG), Beer can be made from a wide range of grains. Most commonly, wheat, barley, corn and rice are used. After fermentation process, wet fibre, cell spent grain is waste residues, many of the breweries lack storage spaces; hence they pay contractors for the disposal of these wastes. Brewers' waste constitutes unpalatable, nauseating environment pollutants. Wet brewer's grains are also donated to livestock farmers who are responsible for the transportation of these wastes, which are used as animal feed [1]. BDG has been utilized as feed for animals for many years [2]. High costs of conventional feed resources have caused inadequate concentrated feeding and low productivity in livestock industry [3]. Cost of production of poultry is associated with the cost of feed. The cost of feed is also related to the cost of ingredients. Maize is a major ingredient in the poultry diets. Its availability and price are influenced by competition between man, industry and livestock. Hence, it makes economic sense to find cheap alternatives for maize in poultry diets. Most of the alternative feed ingredients for maize contain Non-Starch Polysaccharide {NSP} [4]. However, the broilers digestive enzyme profiles are not designed to digest NSP thereby limiting the broilers ability to utilize high fibre feedstuffs. This intolerable high fibre content causes digestive inefficiency of the gastro-intestinal tract thereby reducing the effect of digestive enzymes and absorption of nutrients [5]. Efforts to extract more nutrients from feedstuffs (both conventional and non-conventional) have been a focus for research for decades [6]. In recent times more effort has been directed towards harnessing and utilizing by-products and wastes which are not directly utilizable by man, and take advantage of the convertible mechanism of animal organ to convert what is seen as a waste into wholesome animal product for human consumption. There is variation in the composition of BDG depending on the grains used for brewing. The average BDG has about 23 – 25% protein, high in fibre (14-18%) and low in energy for monogastric animals. The protein is only about 70% digestible [7]. Brewers' dried grain is a common by-product of rice milling that is high in crude fibre of about 12% [8]. Fibre utilization by monogastric livestock has recently gained interest for various reasons, primarily to promote constant passage of materials through the gut and to stimulate growth [9]. The nutritional functions of fibre in the animal body include keeping the digestive system healthy for proper function, aiding and speeding up the

excretion of waste and toxic materials from the animal body. Dietary fibre components undergo a limited conversion to substance available for absorption in poultry and could be degraded only by exogenous enzymes [10]. NSP enzymes acting on the feed carbohydrate fraction are widely used in animal production for their capacity to increase feed digestibility and to decrease the anti-nutritional effects of certain carbohydrates. This allows improved performance or a more efficient use of cheap, low quality carbohydrate-sources without adversely affecting animal performance. NSP enzymes efficiently breaks down the arabinoxylan fraction in feed, thereby resulting in a fast decrease of intestinal viscosity, improved availability of nutrients and energy, increased energetic value of the ration reduction of digestive problems. The addition of enzymes to address NSP viscosity can improve gut health, feed efficiency, improve fecal quality and facilitate the use of lower cost feed ingredients. The benefits of using livestock feed enzymes is to increase the availability of starches and proteins which are enclosed within fibre-rich cell walls and to increase the availability of phosphorus from phytate. Hence, the need to investigate the effect of dietary levels of brewers' dried grain supplemented with or without enzyme on the performance, nutrient digestibility and gastro-intestinal tract characteristics of broilers.

## II. MATERIAL AND METHODS

One hundred and ninety-two (192) one-day old mixed sex broilers of commercial strain (Arbor acre) were used for this experiment. The ambient temperatures during the period of study were 26.6°C (morning), 33.1°C (afternoon) and 30.7°C (evening) with corresponding relative humidity of 72%, 40% and 52% respectively. The birds were housed in an electrically heated battery cage and were fed the experimental diets (Table I) from one-day old to eight weeks. The experimental diet consisted of a 2 × 4 factorial combination of replacement of maize with brewers' dried grain and types of enzymes namely: Roxazyme G (100ppm), Nutrase xyla (150ppm), or Grindazyme (350ppm), and without enzyme (0ppm). BDG was added

at 0 or 25% inclusion level at the expense of maize in the control diet. Each of these was undertaken in the presence of no enzyme or with different commercial enzymes at recommended level. Thus, there were 8 treatments each with 3 replicate cages of 8 chicks (192birds). Experimental diets and water were supplied *ad-libitum*, to the birds and were subjected to routine vaccination programme. The birds were weighed at the beginning of the trial with an average weight of 54.85g and there after every week. Mortality was recorded daily. A nutrient digestibility trial was undertaken when the birds were 3 weeks old. Weighed quantities of feed were supplied and excreta collected over a 72 hour using the total collection method. The excreta samples were weighed, oven dried at 70°C and weighed again to determine their dry matter. Dried excreta were ground prior to chemical analyses. Nutrient digestibility was calculated using the formula:

$$NR = \frac{\text{Nutrient intake} - \text{Nutrient output}}{\text{Nutrient intake}} \times 100$$

NR= Nutrient digestibility

Nutrient intake = weight of dry feed intake × coefficient of nutrient in the feed

Nutrient output = weight of dry excreta × coefficient of nutrient in faeces

Diet and excreta samples were subjected to proximate analysis using method of AOAC [11]. Crude protein was determined using the Kjeldahl procedure. Ether extract was determined by subjecting the samples to petroleum ether (b.p 60-80°C) extraction in a soxhlet apparatus. Crude fibre of the samples was determined by the method described by Cullison [12]. At the end of the feeding trial, 3 birds per replicate were randomly selected, killed by neck decapitation and eviscerated. The crop, proventriculus, gizzard, liver and pancreas were removed and weighed to determine the impact of enzyme usage on the gastro-intestinal tract. Data collected were subjected to statistical analysis using the model for 2 way factorial design [13], significant difference between treatments means were separated using the Duncan's Multiple Range Test [14].

Table I: Composition of experimental diets

Ingredients	1	2	3	4	5	6	7	8
Basal *	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
Maize	50.00	50.00	50.00	50.00	25.00	25.00	25.00	25.00
Brewers' dried grain	-	-	-	-	25.00	25.00	25.00	25.00
0E	0ppm	-	-	-	0ppm	-	-	-
100E	-	100ppm	-	-	-	100ppm	-	-
150E	-	-	150ppm	-	-	-	150ppm	-
350E	-	-	-	350ppm	-	-	-	350ppm
Analyzed nutrient content								
Dry matter	88.21	89.45	89.86	89.63	86.75	87.65	87.72	87.92
Crude protein (%)	19.42	19.46	19.56	19.91	23.15	23.30	23.45	23.60
Crude fat (%)	9.20	8.25	8.35	8.40	8.25	8.33	8.65	8.77
Crude fibre (%)	6.05	5.95	5.91	5.85	11.95	11.90	12.05	12.10
ME (MJ/Kg)	14.15	14.20	14.25	14.22	12.25	12.30	12.35	12.30
Lysine	0.91	0.94	0.94	0.93	0.89	0.88	0.89	0.88
Methionine	0.73	0.75	0.73	0.73	0.65	0.68	0.69	0.69

\*Made up of groundnut cake 26.80%, blood meal 3.00%, palm kernel cake 3.00%, fish meal 2.00%, maize milling waste 10.00%, bone meal 2.35%, oyster shell 0.25%, salt 0.25%, palm oil 2.00%, Di-methionine 0.10%, premix 0.25 (provided per Kg) Vit.A 4,000IU; Vit.D 8000IU; Vit.E 4,000mg; Vit.K 900mg; Vit.B<sub>1</sub> 500mg; Vit.B<sub>2</sub> 2000mg; Vit.B<sub>3</sub> 5,500mg; choline chloride 15,000mg; Antioxidant (BHT) 0.05%; iron 1.8%; copper 0.2%; manganese 2.4%; cobalt 0.05%; zinc 2.8%; iodine 0.04%; selenium 0.18%; calcium 12.8% .  
- Treatment not included, Enzyme I- Nutrase xyla 100ppm, Enzyme II- Roxayzme G 150ppm, Enzyme III- Grindazyme 350ppm.

### III. RESULTS AND DISCUSSION

It is generally accepted that fibres may improve intestinal digestion by reducing the number of goblet cells present on the villous structures in the small intestines, and hence reduce the amount of goblet mucin which acts as a luminal barrier against absorption. This, however, may not always be the case, especially with fibre sources of high molecular weight. The excessive use of such fibre sources in the diet may also increase viscosity of the intestinal content, with a resulting decrease in bioavailability of nutrients, which adversely affects body weight gain and carcass quality. BDG contains non-starch polysaccharides that reduce the utilization of nutrients such that the substitution of BDG for maize increases the viscosity of the digestive contents and interfere with digestion and absorption of nutrients. BDG is a bulky feed that can be used to lighten dense, the large volume created by the BDG inclusion gave the birds' opportunity to waste feed in the attempt at ingredients selection. There was evidence of particle size selection with reference to maize and BDG. Increase in dietary level of brewers' dried grain supplemented with commercial enzyme increased weight gain and improved feed gain ratio ( $P < 0.05$ ). There was no significant effect of enzyme supplementation on feed intake and feed/gain ratio. There was also no significant interaction between levels of brewers' dried grain and enzyme supplementation on feed intake and feed/gain ratio. However there was significant interaction between brewers' dried grain level and type of enzyme on weight gain. Brewers' dried grain is a high fibre feed ingredient, fibre affects feed intake and energy utilization of birds. The primary factor in the voluntary feed intake of chicks appears to be the need for energy [15]. Birds will ordinarily eat to satisfy their energy requirement. As fibre content of diets increases, density of the diets decreases. The inclusion of fibre in feed dilutes energy concentration of diets [16]. Hence, for birds to keep a constant energy level they have to change their feed intake as the energy density of the feed changes, hence the need for increase feed intake. There was significant reduction in feed intake as 50% of dietary maize was replaced with BDG as shown in Table IIa. The BDG also filled up the birds' crop quickly due to its bulkiness and thereby decreasing feed intake. However, the addition of the different types of enzymes increased the feed intake by helping the birds to digest BDG, which is fibrous faster. When 50% of maize was replaced by BDG, the feed/gain ratio increased, meaning that the feed was not efficiently utilized. This is thought to be related to reduce nutrient digestibility associated with increased crude fibre content of the diets with BDG addition without enzyme supplementation. Replacement of maize with BDG without enzyme supplementation caused a reduction in weight gain, this resulted from the fact that the birds consumed less feed

and less energy was released [17]. Supplementation of the diets with the different types of enzymes improved BDG digestion, made more energy to be available to the birds; this increased the weight and at the same time improved feed efficiency. However, this experiment showed that addition of enzyme does enhanced the performance of the birds in terms of weight gain as shown in Table IIb. BDG is a high fibre feed ingredient, fibre affects feed intake and energy utilization of birds. Fibre has been included in experimental diets for monogastric animals for many years primarily to promote constant passage of materials through gut; fibre reduces the digestibility time of feed in the gut not allowing intestinal secretions to act on the feed. Table III showed the effects of the dietary treatment on nutrient digestibility. There was no significant effect of treatments on fat digestibility ( $P > 0.05$ ). Increase in dietary level of brewers' dried grain at the expense of maize caused a significant increase in feed intestinal transit time ( $P < 0.05$ ), however there was no significant effect of the type of enzyme on this parameter. Increase in dietary level of brewers' dried grain in the absence of supplemented enzyme caused significant decrease in protein and fibre digestibility. Some authors [18], [19] reported that increasing fibre concentration of feed causes decreased digestibility of all nutrients, reduced weight and increased faecal bulk as observed in this experiment, there was reduced weight gain, fibre act as a diluents agent which lower nutrient concentration and the effect of this indigestible fraction of carbohydrates can be observed on the anatomy of the digestive tract, the transit time, water losses bringing about poor digestion in monogastric animal. However, this experiment showed that addition of enzyme does enhanced the performance of the birds in terms of weight gain. Enzyme supplementations efficiently break down the arabinoxylan in feed, thereby resulting in a decrease in intestinal viscosity, improved availability of nutrients. Enzyme allows improved performance or a more efficient use of cheap low quality carbohydrate-sources without adversely affecting animal performance [20]. Fibre has been included in experimental diets for monogastric animals for many years primarily to promote constant passage of materials through gut; fibre reduces the digestibility time of feed in the gut not allowing intestinal secretions to act on the feed. Some authors [21]; [22] reported that increasing fibre concentration of feed causes decreased digestibility of all nutrients, reduced weight and increased faecal bulk as observed in this experiment, there was reduced weight gain, fibre act as a diluents agent which lower nutrient concentration and the effect of this indigestible fraction of carbohydrates can be observed on the anatomy of the digestive tract, the transit time, water losses bringing about poor digestion in monogastric animal [23]. Enzyme supplementations efficiently break down the arabinoxylan in feed, thereby resulting in a fast decrease in intestinal viscosity,

improved availability of nutrients. Enzyme allows improved performance or a more efficient use of cheap low quality carbohydrate-sources without adversely affecting animal performance [24]. Table IV showed that there was increase in the weight of crop, proventriculus, gizzard, liver and pancreas when 50% of maize in the control diet was replaced with BDG without enzyme supplementation. This may be as a result of increased activity of these organs. Increased viscosity of the intestinal contents decrease the rate of diffusion of substrates and digestive enzymes and hinders their effective interaction leading to significant modification of the structure and function of the digestive organs. To adapt to these changes, the activities of the intestinal secreting mechanism may be enhanced possibly leading to hypertrophy of the digestive organs. The increased weight of the crop is thought to be the ability to expand in size to meet up the increased activity of storage and the bulky nature of BDG, while increase proventriculus size was associated with the need to produce more enzyme and increased gizzard size was due to the need for more grinding activities resulting in increased musculature consequent on increased fibre content of the diet. The liver equally increase in size in the birds fed BDG without enzyme supplementation, liver plays a major role in metabolism, it produces bile an alkaline compound which aids in digestion via emulsification of lipids. The liver's highly specialized tissues regulate a wide variety of high volume biochemical reactions, including the synthesis and breakdown of small and complex molecules [25]. The various functions of the liver are carried out by the liver cells; these cells can differentiate and probably increase with the need for more work. With enzyme supplementation a greater proportion of non-starch polysaccharide (NSP) was digested thereby attenuating the increased function of the responding organs. NSP enzymes acting on the feed carbohydrate fraction are widely used for the capacity to increase feed digestibility and to decrease the anti-nutritional effects of certain carbohydrates. There was no significant ( $P>0.05$ ) effect of treatments on the size of pancreas. Enzyme supplementation irrespective of the type reduces the workload of the organs investigated. Addition of enzyme

to broiler's feed reduced viscosity of the intestinal digesta and showed a marked improvement on the various morphological effects of feeding fibrous materials to chicken broilers. A viscous digesta slows down digestion processes and encapsulates nutrients, making them inaccessible to digestive enzymes, supplementation of feed with enzyme help to address NSP viscosity. Some authors [26] observed that addition of enzymes to monogastric feed reduced viscosity of the intestinal digesta and showed a marked improvement on the various morphological effects of feeding fibrous materials to non-ruminants. Table V showed detail interactions between dietary levels of BDG and type of enzymes on significant digestibility, weight of crop, proventriculus, gizzard and liver ( $P<0.05$ ).

Increase in the weight of the crop, proventriculus, gizzard and liver in the birds fed diet without enzyme supplementation may be as a result of increased activity of these organs. Increased viscosity of the intestinal contents decrease the rate of diffusion of substrates and digestive enzymes and hinders their effective interaction leading to significant modification of the structure and function of the digestive organs. To adapt to these changes, the activities of the intestinal secreting mechanism may be enhanced possibly leading to hypertrophy of the digestive organs. NSP enzymes acting on the feed carbohydrate fraction are widely used for the capacity to increase feed digestibility and to decrease the anti-nutritional effects of certain carbohydrates [27]. Enzyme supplementation irrespective of the type reduces the workload of the organs investigated. Addition of enzyme to broiler's feed reduced viscosity of the intestinal digesta and showed a marked improvement on the various morphological effects of feeding fibrous materials to chicken broilers. A viscous digesta slows down digestion processes and encapsulates nutrients, making them inaccessible to digestive enzymes, supplementation of feed with enzyme help to address NSP viscosity. Some authors [28] observed that addition of enzymes to monogastric feed reduced viscosity of the intestinal digesta and showed a marked improvement on the various morphological effects of feeding fibrous materials to non-ruminants. Enzyme supplementation has a beneficial effect on the performance of animals.

Table IIa: Effects of dietary levels of brewers' dried grain supplemented with enzyme on bird performance

Dietary treatment	Feed intake g/bird/day	Weight gain g/bird/day	Feed/gain
Level of BDG (%)	*	*	*
0	65.30 <sup>a</sup>	23.71 <sup>b</sup>	2.75 <sup>a</sup>
25	61.15 <sup>b</sup>	19.93 <sup>a</sup>	3.08 <sup>b</sup>
Types of enzyme	*	*	*
0E	61.50 <sup>a</sup>	20.32 <sup>a</sup>	3.03 <sup>a</sup>
100E	64.72 <sup>b</sup>	22.72 <sup>b</sup>	2.85 <sup>b</sup>
150E	64.80 <sup>b</sup>	22.86 <sup>b</sup>	2.83 <sup>b</sup>
350E	64.80 <sup>b</sup>	22.76 <sup>b</sup>	2.84 <sup>b</sup>
BDG × enzyme	*	*	*
S.E.M	3.33	0.72	0.43

NS: Non-significant

\*Means within the same column followed by different subscripts are significantly different ( $P<0.05$ ), S.E.M=Standard Error Mean

Table IIb: Details of Interaction between dietary levels of brewers' dried grain and commercial enzymes on feed intake, weight gain and feed conversion ratio.

	0E	100E	150E	350E
Feed intake: BDG (%)				
0	60.01 <sup>b</sup>	58.41 <sup>a</sup>	58.40 <sup>a</sup>	58.43 <sup>a</sup>
25	67.18 <sup>c</sup>	63.54 <sup>b</sup>	63.50 <sup>b</sup>	63.52 <sup>b</sup>
Weight gain: BDG (%)				
0	22.31 <sup>b</sup>	25.50 <sup>c</sup>	25.51 <sup>c</sup>	25.51 <sup>c</sup>
25	19.42 <sup>a</sup>	23.81 <sup>b</sup>	23.80 <sup>b</sup>	23.80 <sup>b</sup>
Feed/gain ratio: BDG (%)				
0	2.69 <sup>b</sup>	2.51 <sup>a</sup>	2.50 <sup>a</sup>	2.50 <sup>a</sup>
25	2.70 <sup>b</sup>	2.53 <sup>a</sup>	2.52 <sup>a</sup>	2.53 <sup>a</sup>

Different superscripts indicate significant differences (P<0.05)

Table III: Effect of dietary level of brewers' dried grain with or without commercial enzyme supplementation on nutrient digestibility and feed intestinal transit time (FITT)

Dietary treatment	Dry matter (%)	Protein (%)	Fat (%)	Fibre (%)	FITT(hrs)
Level of BDG (%)		*	*	*	*
0	88.34	64.80	84.00	43.70	2.25
25	89.34	60.42	83.20	35.60	2.40
Types of enzyme	NS	*	NS	*	NS
0E	88.35	63.81	82.62	48.50	2.29
100E	88.44	68.30	84.20	56.00	2.27
150E	88.42	68.20	84.21	56.00	2.21
350E	88.44	68.30	84.20	56.21	2.22
BDG × enzyme	NS	*	NS	*	NS
S.E.M	0.77	1.50	0.82	1.56	0.14

\*Means within the same column followed by different subscript are significantly different (P<0.05)

NS: Non-significant

Table IV: Effect of dietary level of brewers' dried grain with or without commercial enzyme supplementation on the gastro-intestinal tract characteristics of broiler

Dietary treatment	g/100g body weight				
	Crop	Proventriculus	Gizzard	Liver	Pancreas
Level of brewers' dried grain (%)	*	*	*	*	*
0	0.58 <sup>a</sup>	0.44 <sup>a</sup>	2.35 <sup>a</sup>	1.72 <sup>a</sup>	0.14 <sup>a</sup>
25	0.72 <sup>b</sup>	0.66 <sup>b</sup>	3.66 <sup>b</sup>	2.90 <sup>b</sup>	0.30 <sup>b</sup>
Types of enzyme	*	*	*	*	NS
0E	0.57 <sup>a</sup>	0.50 <sup>a</sup>	2.20 <sup>a</sup>	1.78 <sup>a</sup>	0.20
100E	0.46 <sup>b</sup>	0.43 <sup>b</sup>	2.10 <sup>b</sup>	1.66 <sup>b</sup>	0.19
150E	0.45 <sup>b</sup>	0.44 <sup>b</sup>	2.11 <sup>b</sup>	1.66 <sup>b</sup>	0.20
350E	0.45 <sup>b</sup>	0.44 <sup>b</sup>	2.10 <sup>b</sup>	1.65 <sup>b</sup>	0.19
BDG × enzyme	*	*	*	*	NS
S.E.M	0.05	0.03	0.04	0.02	0.01

\*Means within the same column followed by different subscript are significantly different (P<0.05)

Table V: Details of interaction between dietary levels of brewers' dried grain and types of commercial enzyme on digestibility and gastro intestinal tract characteristics of broilers

Digestibility	0E		100E		150E		350E	
	0	25	0	25	0	25	0	25
Protein digestibility	64.57 <sup>b</sup>	61.50 <sup>a</sup>	66.01 <sup>c</sup>	65.52 <sup>b</sup>	65.65 <sup>b</sup>	65.21 <sup>b</sup>	66.14 <sup>c</sup>	67.20 <sup>c</sup>
Fibre digestibility	46.91 <sup>b</sup>	41.06 <sup>a</sup>	54.47 <sup>b</sup>	54.45 <sup>b</sup>	56.03 <sup>c</sup>	54.10 <sup>b</sup>	56.19 <sup>c</sup>	54.45 <sup>b</sup>
Organ weight								
Crop	0.51 <sup>b</sup>	0.55 <sup>c</sup>	0.50 <sup>a</sup>	0.51 <sup>b</sup>	0.50 <sup>a</sup>	0.51 <sup>b</sup>	0.50 <sup>a</sup>	0.51 <sup>b</sup>
Proventriculus	0.47 <sup>b</sup>	0.49 <sup>b</sup>	0.44 <sup>a</sup>	0.45 <sup>a</sup>	0.45 <sup>a</sup>	0.44 <sup>a</sup>	0.44 <sup>a</sup>	0.45 <sup>a</sup>
Gizzard	2.21 <sup>b</sup>	2.30 <sup>c</sup>	2.16 <sup>a</sup>	2.15 <sup>a</sup>	2.16 <sup>a</sup>	2.15 <sup>a</sup>	2.15 <sup>a</sup>	2.16 <sup>a</sup>
Liver	1.71 <sup>b</sup>	1.88 <sup>c</sup>	1.66 <sup>a</sup>	1.70 <sup>b</sup>	1.67 <sup>a</sup>	1.70 <sup>b</sup>	1.66 <sup>a</sup>	1.70 <sup>b</sup>

Different superscripts indicate significant differences (P<0.05)

#### IV. CONCLUSION

Increased level of brewers' dried grain and without commercial enzyme supplementation resulted in poor feed conversion, difficulty in feed digestibility. More so, increased level of brewers' dried grain without commercial enzyme supplementation resulted in modification of the structure and function of the crop, proventriculus, gizzard and liver. Nutrient digestibility appreciably improved when the high fibre chicken diets were supplemented with the different types of commercial enzyme. Farmers could replace 50% of maize with brewers' dried grain in the diet of broilers with the brewers' dried grain supplemented with any of the commercial enzyme for better results at low cost of production. The use of commercial enzyme is advantageous in the utilization of high fibre chicken diet.

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