GROWTH PERFORMANCE, HAEMATOLOGY AND ECONOMICS OF PRODUCTION OF BROILER CHICKS ON DIETS WITH VARYING REPLACEMENT LEVELS OF MAIZE-SOYA WITH BREWER DRIED GRAINS

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ABSTRACT
The study evaluated growth performance, blood indices and economics of replacing maize-soya with graded levels of brewer dried grain (BDG) in a maize-soya based diets for broiler chicks. 120-day-old broiler chicks of mixed sexes were used. BDG replaced 0%, 30%, 40% and 50% of combined maize and soya in the control diet as T1, T2, T3 and T4 respectively. 30 birds were on each treatment diet, at 10 birds per replicate in a completely randomized design. The study period was 28 days. Body weight changes and feed intake were recorded on daily basis. Performance indices were measured. Results showed significant (P < 0.05) effect of BDG on all growth parameters and economic indices. The final body weight, daily weight gain and daily feed intake decreased with the increasing replacement level of maize and soya with BDG. Birds had higher average final body weight (g/bird), average daily weight gain (g/bird), Fc/kg feed (₦) and Fc/bird (₦), with the lowest FCR on 0% BDG. However, the final body weight and daily weight gain were similar on 30% and 40% BDG diets. Packed Cell Volume (PCV%), white blood cell (WBC x10³/ul), Platelets (x10³/ul), Lymphocyte (%), Heterophils (%) and Eosinophils (%) were influenced by BDG. However, BDG had no effect on the Hb (g/dL), RBC (x10⁶/uL), Monocytes (%) and Basophils (%) concentrations. The result concluded that 40% of maize-soya can be replaced economically with BDG without any serious negative effect on growth and health of broiler starter chicks.
Keywords: Growth, Blood, Brewer dried grain, Maize, Broiler, Cost

INTRODUCTION

The cost of conventional livestock feed ingredients, especially maize and soya beans have continually been on the increase. These ingredients serves as main energy and protein sources in poultry feed. Energy sources, particularly maize, contribute the largest portion of poultry rations. Soya bean is an oil seed legume that is rich in protein and used for both human and animal feeding and for industrial purposes. The cake is the major source of protein for non-ruminant feeding. BDG has become a widely used ingredient as animal feed due to high protein content with arrays of essential amino acids. It was reported by Esiegwu (2016) that soya beans can constitute about 20 - 30% of poultry ration. Viable alternatives that can replace maize and soya beans are now being explored by poultry farmers and nutritionist due to their high cost and competition by humans. Attention is now focused on the use of unconventional feedstuffs, such as agro-industrial by-products, in the formulation of poultry diets. Of considerable interest is the brewer dried grain. Dried brewers' grain is high in crude protein and metabolizable energy (Tikunesh *et al.,* 2022). Abd El-Hack *et al*., (2019) stressed that BDG can be used to reduce the quantity of maize grain and soybean meal in broiler chicken diets. Brewers' grains are obtained in wet form, and because they deteriorate easily, they are normally dehydrated, resulting in dried brewers' grains (DBG). According to Ashour *et al., (*2019), Ashour *et al.* (2019) used DBG at levels up to 120 g/kg in broilers from 7 to 42 days old and observed that there was no positive effect of BDG inclusion on growth performance. However, Fasuyi *et al.,* (2018) observed the highest weight gain at 30% inclusion rate when ensiled brewery grain was fed to starting and growing broiler chickens. Blood indices provide valuable information about the health and physiological status of the birds. Pandian *et al*., (2021) reported a normal range of 2.78 x10^6/ul, 36.83%, and 12.13 g/dl respectively, for RBC, PCV, and Hb of domestic birds. Conducting laboratory examinations of blood to assess its components is a crucial procedure that aids in diagnosing various diseases and dysfunctions. This study was conducted to evaluate amount of BDG that could be used to replace maize and soya in poultry feed at a lower cost without significant negative impact on the production performance and blood response of broiler chickens.

MATERIALS AND METHODS

Animals and Experimental Design

The research work was conducted at the Poultry Unit of the Teaching and Research Farm of Ekiti State Polytechnic, Isan Ekiti. Major ingredients; maize, soya and BDG used for this research work were analysed for their proximate components **(Table 1)**.

A total of 120 broiler chicks were used for the trial. Chick brooding was carried out on a floor pen in an open-sided wall building. Heat was provided from burning charcoal in pots. 30 birds were on each treatment diet, which was replicated three times, and each replicate consisted of 10 birds in a completely randomized design. Formulated diets were free of feed additives. Toxin binder ws added at a rate of 1g/1000g feed. Chicks were fed

Table 1: Proximate Composition of Ingredients

Parameters	MAIZE	SOYBEAN S	BREWER DRIED GAIN
Crude Fat (%)	6.37	4.40	2.80
Ash content (%)	6.97	5.52	14.41
Crude fibre (%)	4.17	6.88	17.60
Crude Protein (%)	16.18	52.15	34.57
CHO (%)	63.19	30.37	40.54
ME (Kcal/Kg ME)	3357.29	3363.91	2945.06

ME – Metabolisable energy

pre-starter diet for the first 7 days before they were placed on the experimental diets from 7 – 28 days. There was food and clean water for the birds to drink without restriction. In diets T1, T2, T3 and T4, BDG replaced 0%, 30%, 40% and 50% of combined maize and soya in the control diet respectively **(Table 2).**

Table 2: Gross composition of Experimental diets of broilers starter fed Brewer Dried Grain

	REPLACEMENT LEVELS			
Ingredients	0% BDG	30% BDG	40% BDG	50% BDG
Maize	66.50	50.00	44.89	37.79
Soybean meal	29.09	16.91	12.46	10.00
Bone meal	1.91	1.91	1.91	1.91
Limestone	0.15	0.15	0.15	0.15
Fish meal	1.50	1.50	1.50	1.50
Brewer Dried Grain	0.00	28.68	38.24	47.80
Palm oil	0.00	0.00	0.00	0.00
Salt	0.25	0.25	0.25	0.25
L-Lysine	0.15	0.15	0.15	0.15
DL-Methionine	0.20	0.20	0.20	0.20
Premix	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00
Calculated nutrient values				
Crude protein (%)	21.71	22.47	22.92	20.61
ME (Kcal/kg)	3083.16	2954.24	2935.17	2904.69
Analysed Proximate values				
Crude Protein (%)	21.90	22.81	22.99	20.82
ME (Kcal/kg)	3214.13	3113.59	3103.29	3068.84

Note – ME- Metabolisable energy

The proximate makeup of test ingredients is displayed in Table 1. Body weights were recorded at the end of each week, while feed consumption was recorded on daily basis. The feed conversion ratio (FCR) and daily weight gain were also computed. At four weeks of age, blood samples were obtained from two birds per replicate for haematological indices. Collected blood samples were analysed for haemoglobin (Hb), packed cell volume (PCV), RBC, and white blood cells (WBC) counts and its differentials concentrations.

Chemical Analyses

Proximate composition of ingredients; maize, Soybean , brewer dried grain and compounded experimental diets were determined as described by AOAC, (2010).

Statistical Analysis

Data generated were analysed using one-way analysis of variance (ANOVA) of SAS (2008) package for Windows. To separate significant differences among means, Duncan multiple range test was used.

RESULTS AND DISCUSSION

Calculated and Proximate composition of experimental diets are shown in table 2

Calculated and Proximate composition of experimental diets are presented in Table 2. Proximate data obtained were similar to the calculated values obtained.

Growth performance characteristics of Broiler Starter fed BDG

Table 3 shows the performance characteristics of broiler starter fed brewer dried grain in replacement for maize and soya beans. There was significant *($P < 0.05$)* effects of BDG inclusion in the diets on all growth indices evaluated. The final body weight and daily weight gain decreased with increasing replacement level of maize and soya with BDG. However, the final body weight and daily weight gain were significantly *($P < 0.05$)* similar on

diets 2(30% BDG) and 3(40% BDG) which in turn were significantly *(P < 0.05)* lower than those on the control diet (0% BDG). This was similar to the result of Tikunesh *et al.* (2022) that average daily gain, final body weight and feed conversion ratio were higher for starter broiler chicks on diet with 0% BDG. The result showed that birds consumed more on diet 2(30% BDG) and had the highest Feed cost per unit weight gain (₦45.79/bird). The higher daily feed intake on diet 2 (30% BDG) did not translate to improved weight gain and did not show any advantage of birds on the diet compared to diet 3(40% BDG) which had lower feed consumption and FCR. Feed cost/kg feed (₦) and Feed cost/bird (₦) reduced with increasing replacement level of maize and soya with BDG. Feed cost per unit weight gain were significantly *(P < 0.05)* higher on diet 2 (₦45.79/bird). Mortality was not recorded accross treatment. The higher feed cost and Feed cost/bird (₦) of diet 1 may not be economical for the production of broiler chicken.

Table 3: Growth Performance Characteristics of Broiler starter fed varying inclusion levels of BDG

Parameters	REPLACEMENT LEVELS				SEM	p-value
	0% BDG	30% BDG	40% BDG	50% BDG		
Initial body weight (g/bird)	36.60	36.67	36.40	36.08	0.4673	0.9802
Final body weight (g/bird)	1367.30^{a}	1009.00^{b}	1008.13^{b}	925.50^{c}	51.4773	<.0001
Daily weight gain (g/bird)	47.53^{a}	34.72^{b}	34.71^{b}	31.77^{c}	1.8372	<.0001
Daily Feed Intake (g/bird)	72.67^{b}	74.38^{a}	72.54^{c}	70.31^{d}	0.4362	<.0001
FCR	1.53^{d}	2.14^{b}	2.10^{c}	2.21^{a}	0.0823	<.0001
Fc/kg feed (₦)	946.87^{a}	763.69^{b}	702.01^{c}	643.39^{d}	34.3207	<.0001
Fc/bird (₦)	1926.72^{a}	1590.42^{b}	1425.95^{c}	1266.56^{d}	73.7414	<.0001
Fc/weight gain/bird (₦)	40.54^{c}	45.79^{a}	41.36^{b}	39.87^{d}	0.6985	<.0001

Means within rows within parameters with different superscripts are significantly different (*P* < 0.05). *FCR – Feed Conversion Ratio, Fc- Feed Cost, SEM: Standard Error of* Mean

Considering the significant *(P < 0.05)* similarity of final body weight and daily weight gain on 30% and 40% BDG, with the lowest FCR, Feed cost/kg feed (₦) and Feed cost/bird (₦) on 40% BDG, it can be concluded that replacing 40% of conventional maize and soya in compounded ration with BDG in starting broiler chicken feed could not impair growth negatively.

Haematological Indices of of Broiler starter fed varying inclusion levels of BDG

Table 4 shows blood response of broiler starter to varying levels of BDG replacement for maize-soya.

The result showed significant (p<0.05) differences for the PCV (%), WBC (x10^3/ul), Platelets (x10^3/ul) , Lymphocyte (%), Heterophils (%), and Eosinophils (%).values across the treatments. The Hb (g/dL), RBC (x10^6/uL), Monocytes (%) and Basophils (%) were not (p>0.05) influenced by BDG inclusion in the diets.

Table 4: Haematological Indices of of Broiler starter fed varying inclusion levels of BDG

PARAMETERS	REPLACEMENT LEVELS				**SEM**	**p-value**
	0% BDG	30% BDG	40% BDG	50% BDG		
PCV (%)	20.00^{ab}	18.00^{c}	21.00^{a}	19.00^{bc}	0.3942	0.0114
Hb (g/dL)	6.20	5.50	6.90	5.50	0.2690	0.1993
RBC (x10^6/uL)	1.46	1.16	1.77	1.32	0.2153	0.8299
WBC (x10^3/ul)	20.25^{a}	12.3^{b}	10.50^{c}	10.50^{c}	1214.98	<.0001
Platelets (x10^3/ul)	213.00^{a}	106.00^{d}	115.00^{c}	120.00^{b}	13056.69	<.0001
Lymphocyte (%)	54.00^{a}	49.00^{bc}	50.00^{b}	48.00^{c}	0.71648	<.0001
Heterophils (%)	39.00^{c}	44.00^{a}	42.00^{b}	45.00^{a}	0.72043	<.0001
Monocytes (%)	3.00	4.00	2.00	3.00	0.29531	0.1014
Eosinophils (%)	3.00^{bc}	2.00^{c}	6.00^{a}	4.00^{b}	0.4905	0.0021
Basophils (%)	1.00	1.00	0.00	0.00	0.2539	0.2987

Means within rows within parameters with different superscripts are significantly different (*P* < 0.05).

The PCV (%),WBC (x10^3/ul). The WBC (x10^3/ul) was (p<0.05) similar on diets 3 (40% BDG) and 4 (50% BDG) replacement levels. The simlarity in haematological parameters observed across treatments in this study is in consonant with the result of Tikunesh et al., (2022) who reported similar results (p>0.05) among each treatment

diet in Haematology parameters. These results indicated that BDG had no negative effect on the health of broiler chicken considering that mortality did not occur on all the treatments.

The Hb (5.50 -6.90g/dl) were lower than Hb (7.66-12.06g/dl) reported broiler chicken by Odukoya *et al.* (2022). The Monocytes (2.00 - 3.00 %) and Basophil (0.00 – 1.00%) recorded in this study fall within the Monocytes (2.00-3.67%) and Basophil (0.00 – 1.00%) reported for broiler by Asaniyan and Akinduro (2020). The non-significant effect of BDG on Hb (g/dL) and RBC ($x10^6$/uL) in this study agreed with the findings of Tikunesh *et al.,* (2022) who reported that blood constituents assessed for haematological indices were not affected by replacing soybean meal with brewery dried grain.

CONCLUSION AND APPLICATION

Brewer Dried Grain can conveniently replace 40% of maize-soya in broiler starter diet without any negative effect on growth performance and health of the birds.

Incorporating BDG into broiler feed will reduce the overall cost of broiler production.

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