



GROWTH PERFORMANCE AND CARCASS YIELD OF BROILER CHICKENS FED FOUR COMMERCIAL DIETS

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ABSTRACT

This study was conducted to determine the growth performance, carcass characteristics and cost benefit of feeding four different commercial diets to broiler chickens. Two hundred and eight (208) day-old chicks were randomly allotted to four diets in replicates of four. The diets were designated as A, B, C, and D. Each replicate had 13 birds assigned in a completely randomized design. Feed and water were supplied *ad libitum* and the trial lasted for 42 days. Results for growth performance revealed a significant ($P < 0.05$) effect of diet on nearly all indices in the starter, finisher and overall phases. At four weeks, birds fed diets C and A had significantly ($P < 0.01$) higher weights (1252.00 and 1230.70g) than those on diet D (1118.00g) followed by those fed diet B (1012.80g). Total weight gain was higher ($P < 0.001$) on diet D (1933.00g) than those on diet A (1663.70g), while those on diets B (1588g) and D (1511.00g), were similar and had the lowest weights. There was no significant effect of diet on total feed intake (2978.40 – 3232.40g) and overall feed efficiency (0.46 – 0.55). Carcass characteristics indicated that birds fed diet C (1.87kg) had higher carcass weights, followed by those on diet A (1.64kg) and D (1.56kg) which were statistically similar. The lowest carcass weight was recorded in broiler birds fed diet C (1.38kg). However, there was no significant influence of diet on dressing percentage (68.25 – 74.76%). Feed cost per kg varied from ₦880 - ₦960 and feed cost per kg gain was lowest on diet A (₦1579.76) and highest on diet D (₦1789.14). It was concluded that growth rate was similar for both diet A and C. however diet C was most economical and is recommended for profitable broiler chicken production.

Keywords: Broiler, Performance, Commercial feeds, Carcass indices, cost-benefit.

INTRODUCTION

The poultry enterprise remains a significant contributor in Nigeria's GDP. It is an important sector of the economy that provides employment and supports the livelihoods of an estimated 65% of Nigerians (Endacott *et al.*, 2021). The industry's popularity in the country stems from the ease of raising poultry birds and their adaptability to the Nigerian environment (Olajide *et al.*, 2020). According to Ahaotu *et al.* (2017), modern poultry production was introduced in Nigeria in the late 1950s when it became clear that cattle expansion could not meet the increasing demand for meat. In 2022, the poultry bird population was 249 million, compared to 300 million in Egypt, the leading country in Africa (Statista, 2023). Of this number, 21% is managed under the intensive system (LiveGAPS, 2023). Although the poultry industry is well established in Nigeria, production remains low compared to temperate regions. This disparity can be attributed to environmental and managerial factors, particularly nutrition. Poultry birds require specific nutrients in precise quantities and proportions for optimal productivity. Consequently, practical poultry diets are formulated from a mixture of ingredients, including cereal grains, cereal by-products, fats, plant protein sources, vitamin and mineral supplements, crystalline amino acids, and feed additives. The standard practice is to



formulate a balanced diet and compound the feeds using high-quality ingredients. However, due to financial constraints and lack of skills, many poultry farmers rely on commercial feeds that are not always of the expected quality. Erratic changes in feed material prices often force feed manufacturers to alter formulas to maintain reasonable gross margins (Edache *et al.*, 2018). Over time, this has caused significant financial losses to farmers, hindering the poultry industry (Dutta *et al.*, 2020). To mitigate this problem, it is necessary to raise awareness among farmers about the availability of substandard feeds in the market. This information can be sourced from research findings.

Recent research works (Babale *et al.*, 2016; Ahaotu *et al.*, 2017; Abdullahi *et al.*, 2023) have revealed the presence of substandard commercial poultry feeds in many Nigerian markets, adversely affecting broiler chicken production. This situation necessitates coordinated efforts from both the government and researchers to address this issue. Researchers can contribute by evaluating various feed brands through physical, chemical, or biological methods. One effective biological method involves assessing the performance and carcass traits of the birds.

MATERIALS AND METHODS

Study Area

The experiments were conducted at the Poultry Unit, Teaching and Research Farm, Abubakar Tafawa Balewa University, Bauchi, Nigeria. Bauchi, is located within the southern guinea savannah on latitude 10.31 N and longitude 9.84 E. Furthermore, it is 616 metres above sea level characterized by two well-defined seasons; Rainy season (May - October) and dry season (November - April). The average annual rainfall is 1009 mm, highest relative humidity 94 % (August) and the lowest 35 % (February). Temperatures are between 13 – 17 °C (December – February) and 36 – 37 °C (March – April) (World Atlas, 2017).

Commercial Broiler Chicken Diets

Four different brands of commercial diets were procured from feed vendors in Bauchi. The diets were designated as A, B, C and D. Results for laboratory analysis of samples are presented in Tables 1 and 2.

Table 1: Chemical Composition of Five Selected Starter feed Fed to Broiler Chickens (Starter Phase)

Parameters	Diets			
	A	B	C	D
Crude protein (%)	22.80	22.00	23.00	22.00
Crude fat (%)	4.00	5.00	5.50	4.52
Crude fibre (%)	5.00	5.00	3.00	5.00
Calcium (%)	1.00	1.00	1.20	1.00
Available phosphorus (%)	0.50	0.45	0.50	0.50
Lysine (%)	1.33	1.29	1.30	1.00
Methionine (%)	0.60	0.58	0.56	0.80
*Metabolizable energy (kcal/kg)	2900.00	3000.00	3050.00	3024.00

*Calculated according to Ponzenga (1985)

Table 2: Chemical Composition of Five Selected Finisher feed Fed to Broiler Chickens (Finisher Phase)

Parameters	Diets			
	A	B	C	D
Crude protein (%)	20.00	20.00	19.50	20.90
Crude fat (%)	6.00	4.80	5.50	6.40
Crude fibre (%)	5.00	4.00	3.00	3.74
Calcium (%)	1.25	1.20	1.20	1.84
Available phosphorus (%)	0.40	0.45	0.44	0.65
Lysine (%)	1.10	1.25	1.20	1.20
Methionine (%)	0.55	0.50	0.50	0.52
*Metabolizable energy (kcal/kg)	3024.00	3055.00	3100.00	2970.00

*Calculated according to Ponzenga (1985)

Experimental Design and Management of Broiler Birds

Two hundred and four day-old broiler chicks were brooded for two weeks and randomly allotted to four different commercial diets designated as A, B, C and D in a completely randomized design. Each diet was replicated 3 times with 17 birds each. Feed and drinking water were served *ad libitum* and the study lasted for 42 days.

Data Collection

Growth performance data which includes daily feed intake, daily weight gain, feed conversion ratio and mortality were collected. Daily feed intake was obtained by the difference between the quantity of feed offered and the left-over retrieved the following morning. Weight gain was determined by the difference between two consecutive weights carried out on a weekly basis. This value was divided by 7 to obtain DFI while FCR was the value obtained when DFI was divided by DWG.

At the end of the 6 weeks, two (2) birds were randomly selected from each replicate for carcass analysis. The birds were starved of feed for 12 hours after which they weighed individually, slaughtered, plucked and eviscerated. Dressing percentage was determined using the relationship:

$$\text{Dressing \%} = \frac{\text{Carcass weight} \times 100}{\text{Live weight}}$$

Data Analysis

Data collected were subjected to One Way Analysis of Variance (ANOVA) using IBM SPSS statistics 25 for windows (SPSS, 2017). Means were separated through the Duncan Multiple Range Test of the same software at $P < 0.05$, $P < 0.01$ and $P < 0.001$ levels of significance.

RESULTS AND DISCUSSION

Growth Performance

Results for growth performance of broiler chickens fed commercial diets are presented in Table 3. Most parameters showed a significant ($P < 0.05$, $P < 0.01$ and $P < 0.001$) influence of diet. This confirms an earlier report by Hafizu *et al.* (2020). Weight of birds at 4 weeks, showed a significant ($P < 0.01$) effect of diet in favour of diets C (1252.00g) and A (1230.70g) which were the same, followed by diet D (1118.00g) and lastly diet B (1012.80g). Birds on diets C (2111.30g) which compared favourably with those on diet A (1836.70g) had higher ($P < 0.001$) final weights than those on diets B (1763.30g) and D (1686.00g) which did not differ. The



values obtained in this study are comparable with 772.70 – 1730g reported by Muazu *et al.* (2020) using commercial diets. Total weight gain was higher ($P<0.001$) in birds fed diet C (1933.00g) followed by those fed diet A (1663.70g) and lowest on diets B (1588.40g) and D (1511.00g) which were similar. There was no significant effect of diet in total feed intake (2978.40 – 3232.40g).

At the starter phase, daily feed intake was higher ($P<0.05$) in birds fed diets D (92.34g) and C (88.41g) which were the same. however, daily weight gain (DWG) was higher on diets (59.61g) and A (58.60g) which also did not differ. Feed conversion ratio was better ($P<0.001$) and similar in groups fed diets A (1.43), C (1.48) and D (1.78) than those on diet B (1.77). Mortality of only one bird each, was recorded on diets B and D. Daily feed intake was not significantly affected at the finisher phase (114.69 – 137.57g). On the contrary, daily weight gain was higher ($P<0.05$) in birds fed diet C (64.93g) followed by those on diet B (57.57g), then those on diets A (45.97g) and D (41.03g) which were the same.

There was no significant difference among diets in feed conversion ratio (2.15-2.84) and feed efficiency (0.37 – 0.47) at the finisher phase. Similarly, no mortality was recorded at this phase. Among the parameters studied at the overall phase, only daily weight gain was significantly ($P<0.05$) influenced. Birds fed diet C (62.27g) had a higher mean value for DWG followed by those on B (52.90g) and A (52.29g) which did not differ, and those on diet D (46.85g), the lowest. Overall feed conversion ratio was within the range of 1.96 and 2.19. These values are comparable to those reported by Yisa *et al.* (2020) in a similar study.

Table 3: Growth Performance of Broiler Chickens Fed Four Commercial Diets at the Starter, Finisher and Overall Phases

	Diets				
Parameters	A	B	C	D	SEM
Productive performance					
Initial wt. (g)	172.94	174.9	178.36	175	3.74 ^{NS}
Weight at wk. 4 (g)	1230.70 ^a	1012.80 ^c	1252.00 ^a	1118.00 ^b	52.24 ^{**}
Final weight (g)	1836.70 ^{ab}	1763.30 ^b	2111.30 ^a	1686.00 ^b	57.57 ^{***}
Total weight gain (g)	1663.70 ^b	1588.40 ^c	1933.00 ^a	1511.00 ^c	55.57 ^{***}
Total feed intake (g)	2978.40	3120.80	3232.40	3069.20	149.34 ^{NS}
Starter Phase					
Daily feed intake (g)	84.03 ^b	85.78 ^b	88.41 ^a	92.34 ^a	3.05 [*]
Daily weight gain (g)	58.60 ^a	48.22 ^b	59.61 ^a	53.24 ^b	2.49 ^{**}
Feed conversion ratio	1.43 ^a	1.77 ^b	1.48 ^a	1.73 ^a	0.08 ^{***}
Feed efficiency	0.69 ^a	0.56 ^b	0.67 ^a	0.58 ^b	0.03 ^{***}
Mortality	0	1	0	1	
Finisher Phase					
Daily feed intake (g)	121.37	131.93	137.57	114.69	16.21 ^{NS}
Daily weight gain (g)	45.97 ^c	57.57 ^b	64.93 ^a	41.03 ^c	7.23 [*]
Feed conversion ratio	2.64	2.29	2.15	2.84	0.34 ^{NS}
Feed efficiency	0.38	0.45	0.47	0.37	0.06 ^{NS}
Mortality	0	0	0	0	
Overall Phase					
Daily feed intake (g)	102.69	108.86	112.99	102.15	7.85 ^{NS}
Daily weight gain (g)	52.29 ^b	52.90 ^b	62.27 ^a	46.85 ^c	3.36 [*]
Feed conversion ratio	1.96	2.05	1.82	2.19	0.15 ^{NS}
Feed efficiency	0.51	0.49	0.55	0.46	0.04 ^{NS}
Mortality	0	1	0	1	

a,b,c Means within row with different superscripts differed significantly @ $P < 0.05$, $P < 0.01$ and $P < 0.001$, SEM = Standard Error of the Mean, NS = Not significant

Carcass Characteristics of the Broiler Chickens

The results for carcass characteristics of broiler chickens fed four commercial diets is presented in Table 4. Most of the parameters studied showed a significant $P < 0.05$, $P < 0.01$ and $P < 0.001$ influence of diet. This may be an indication that there is variability in the chemical composition of the diets. Live weight of birds (2.02-2.62kg) did not differ among diets. Birds on diet C recorded higher ($P < 0.001$) carcass weights than those on diets A (1.64kg) and D (1.56kg) which were the same and higher than 1.38kg obtained for birds on diet B. Dressing percentage (68.25-74.76%) did not differ significantly among diets. These values are comparable with 65.70 – 70.77% recommended by Salami *et al.* (2004) for welldressed broiler chickens. The values obtained in this study are also comparable with 61.52 – 74.52% reported by Bello *et al.* (2022) in broiler chickens fed different commercial diets. Relative weight of gizzard which also did not differ among treatments, ranged between 1.29% (diet A) and 1.59% diet B. liver weight was between 2.08 and 2.53% on diets D and B respectively. Spleen weight was from 2.47% (diets C and D) to 2.66% (diet B).

Table 4: Carcass Characteristics of Broiler Chickens Fed Four Commercial Diets

Parameters	Diets				SEM
	A	B	C	D	
Live weight (kg)	2.19	2.02	2.62	2.24	0.14 ^{NS}
Plucked wt (kg)	2.06 ^b	1.93 ^b	2.51 ^a	2.05 ^a	0.12***
Carcass wt (kg)	1.64 ^b	1.38 ^c	1.87 ^a	1.56 ^b	0.13***
Dressed (%)	74.76	68.25	71.39	70.09	4.21 ^{NS}
Gizzard (%)	1.29	1.59	1.33	1.44	0.17 ^{NS}
Liver (%)	2.12	2.53	2.3	2.08	0.34 ^{NS}
Spleen (%)	0.14	0.19	0.17	0.22	0.03 ^{NS}
Head (%)	2.56	2.66	2.47	2.47	0.58 ^{NS}
Legs (%)	3.95	3.95	3.83	2.99	0.44 ^{NS}

a,b,c Means within row with different superscripts differed significantly ($P < 0.001$), SEM = Standard Error of the Mean, NS = Not significant.

Cost-Benefit Analysis

Results for cost benefit analysis of broiler chickens fed four different commercial diets is presented in Table 5. Total feed intake of birds was highest on diet C (3.23kg), followed by diet B (3.12kg), diet D (3.07 kg) and diet A (2.98kg). Feed cost in Naira per kg, was lower and the same on diets A, B and D (₦880.00) but higher on diet C (₦960.00). Feed cost per kg gain was lowest on diet A (₦1579.76) and highest on diet D (₦1789.14).

Table 5: Cost-Benefit of Broiler Chickens Fed Four Commercial Diets

Parameters	Diets			
	A	B	C	D
Total feed intake (kg)	2.98	3.12	3.23	3.07
Feed cost (N)	880	880.00	960.00	880.00
Total feed cost (N)	2622.40	2745.60	3100.80	2701.60
Total weight gain (kg)	1.66	1.59	1.93	1.51
Feed cost/kg gain (N)	1579.76	1726.79	1600.53	1789.14

COCNCLUSION AND RECOMMENDATION

Based on the findings of this study, broiler chickens fed diet A, which had the lowest feed cost per kg gain is nutritionally superior and more economical than other diets. Therefore, diet A is recommended for broiler chicken producers in the study area.

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