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Research Article

Effect of Feeding Different Level of Dietary Energy at Finishers Phase on the Performance of Broiler Chicken in Hot Dry Season

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ABSTRACT

An experiment was conducted to investigate the response of broiler chickens (Marshall strain) to different dietary energy levels. Four experimental diets containing 2800, 2900, 3000, and 3100 kcal/kg of metabolizable energy (ME) with 21% crude protein were prepared. A total of 200 broiler chickens were randomly divided into four treatment groups, each replicated five times with 10 birds per replicate. The results showed that daily feed intake was not significantly different between treatments 1 and 2, but differed significantly with treatments 3 and 4. Significant differences were observed in average daily dietary energy levels, feed conversion ratio (FCR), and cost of feed across the treatments. However, no significant differences were found in average daily gain and water intake. The study revealed that treatments 3 and 4 (3000-3100 kcal/kg ME) resulted in better performance parameters, indicating that these dietary energy levels are suitable for optimal performance of broiler chickens in a semi-arid environment. The results also showed that feed cost per kilogram weight gain was significantly different across the treatments, indicating that the most cost-effective diet should be selected based on the production goals and market conditions. Overall, the study provides valuable information on the nutritional requirements of broiler chickens in a semi-arid environment and highlights the importance of optimizing dietary energy levels to achieve better performance and reduce production costs.

Keywords: Broiler chickens; Energy; Hot season; Cost of feed; Feed intake; Water intake; Weight gain; Mortality

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INTRODUCTION

High environmental temperature is one of the major concerns for broiler producers in many countries of the world, especially in hot tropics, which necessitate investigating the effect of hot season and dietary nutrient level on the growth performance of broilers. Since the broilers have no sweat glands and are mostly fully covered with feathers. The thermoregulations are challenged under hot weather of the semi-arid environment, which is believed to affect feed intake, body weight gain, and feed conversion ratio as the result of

adaptive responses to the hot season (Lin *et al.,* 2005).

Poultry refers to all domesticated birds that are kept for meat and egg production, or any other purpose such as for research and esthetic (prestige). These include domestic fowl, guinea fowl, duck, geese, turkeys, Ostrich, etc. (Oluyemi and Roberts, 2009). These groups of animals are also referred to as monogastric (non-ruminants) animals because of their single stomach compartment and hence the inability to digest a large quantity of fibrous feed material. Oluyemi and Roberts, 2009).

Agriculture, including poultry production, is the most important sector of the Nigerian economy, employing about 75% of the populace (CBN, 2007). In Nigeria, poultry production is a major contributor to animal protein (FAO, 2018).

Poultry meat is the second most widely consumed meat in the world (FAO, 2018). A recent survey by (FAO, 2018) reported that the total poultry meat consumption has increased from 91 million tons in 2009 to 125 million tons in 2018 and is forecast to increase nearly 3% in 2019. In the light of this, the poultry industry is obliged to continuously grow for a steady supply of quality and proteinous meat. Chicken meat provides high quality protein and high concentration of polyunsaturated fatty acids (Wapi *et al*., 2013).

In Nigeria, poultry production is major contributor to animal protein. The predominant systems of poultry production in Nigeria are subsistent raised in open houses with poor ventilation impairing heat exchange, result in economic losses (Hassan and Reddey, 2012).

MATERIALS AND METHODS

Study Area

The study was carried out at the Poultry Production Unit of the Teaching and Research Farm of the Usmanu Danfodiyo University Sokoto Veterinary Clinic, Sokoto. Sokoto lies on latitude 13^{O} 05' 00" N and 5^{O} 15' 00" E, within the Sudan Savannah Zone, in the extreme north western part of Nigeria and at an altitude of 350m above the Sea level (Mamman *et al*., 2000) Rainfall is between May and September with a peak in August. The average annual Rainfall is about 750mm. The mean annual Temperature is 34.9 °C with the highest Temperature (42 °C) recorded in April and the minimum Temperature (13.2 °C) occurring in January (Anonymous, 2007).

Experimental Procedure

A total of two hundred (200) day old broiler chicks of marshal strain averaging 35g were used for the study. The birds were reared on deep litter with all routine management throughout the experimental period of 4weeks with feed and watered *ad libitum*. The experimental design used was a completely randomized design (CRD), with four (4) treatments consisting of different levels of energy (2800kcal/kg, 2900kcal/kg, 3000kcal/kg, 3100 kcal/kg) as T1, T2, T3 and T4. Each treatment was replicated five (5) times with ten (10) birds per replicate.

The composition of ingredients and nutrients in the experimental diets is shown in Table 1.

Daily Feed intake (FI) was recorded by subtracting feed left over from the quantity of feed given. Water intake (WI) was recorded by subtracting the leftover from the quantity of water given. Weight gain (WG) was recorded every week by subtracting the previous body weight from the current weight for each week; average daily gain (ADG) was obtained by dividing weekly gain by seven (7). Record of feed intake and weight gain were used to calculate the feed conversion ratio (FCR) and mortality was recorded as it occurs to adjust the total number of birds. The birds were weighed early in the morning before receiving any feed and water using a weighing balance at a weekly interval during the experimental period. Initial and final weight of the birds was measured at the beginning and end of the experiment, respectively.

FCR= $\frac{feed\ intake}{weight\ gain}$

Cost of Feed (N/kg) was calculated from the cost of individual ingredients used in feed preparation and feed cost per kilogram weight gain (Naira) was calculated by multiplying feed cost per kilogram by feed conversion ratio.

Data Analysis

Data obtained from feed intake, water intake, average daily gain, feed conversion ratio and carcass evaluation were subjected to analysis of variance (ANOVA) using Stat View Analytical computer package version 5. Least significant difference (LSD) was used for means comparison at $P<0.05$ while mortality was calculated in percentage.

Table 1: Composition (%) of experimental diets

	Finisher (5-7 weeks)			
Ingredients	**Diet 1**	**Diet 2**	**Diet 3**	**Diet 4**
Maize	47.00	48.00	45.00	49.60
Corn bran	-	3.10	1.30	-
Wheat offal	16.25	8.90	2.50	4.00
Rice brand	-	-	10.00	5.90
Fish meal	2.50	1.51	0.72	2.00
Soya bean meal	13.05	15.00	15.00	19.80
Groundnut cake	13.75	15.36	15.00	11.00
Blood meal	3.00	3.01	4.00	3.00
G/Oil	1.00	2.06	3.16	4.00
Limestone	1.00	1.50	2.00	1.40
Bone meal	1.00	1.10	2.50	1.00
Salt	0.25	0.20	0.25	0.20
Premix	0.25	0.20	0.25	0.25
Methionine	0.25	0.20	0.20	0.20
Lysine	0.20	0.20	0.20	0.20
Total	**100.00**	**100.00**	**100.00**	**100.00**
Calculated analysis				
Energy(kcal/kg)	2810.10	2902.92	3000.84	3089.64
Crude protein (%)	21.01	21.00	21.00	21.00
Crude fibre (%)	4.83	4.83	4.85	4.50
Ether extract (%)	3.67	3.59	5.65	4.91
Calcium (%)	0.89	1.00	1.02	1.00
Phosphorus	0.54	0.51	0.51	0.54
Methionine	0.55	0.50	0.50	0.51
Lysine	1.31	1.30	1.32	1.33
Cost of feed (N/kg)	**149.36**	**157.19**	**158.65**	**167.79**

RESULTS AND DISCUSSION

General Performance of Broiler Chickens at Finisher phase (5-7weeks)

Result on the performance of experimental broiler chickens in the finisher phase is presented in Table 2. Results of the experimental broiler chickens fed varying dietary energy levels in hot dry period at finisher phase showed that daily feed intake was highest (67.71g) in treatment 4 and lowest (56.07g) in treatment 2. Feed intake was significant (P<0.05) in all of the treatments. However, daily feed intake was not significant (P>0.05) between treatment 1 and 2 but differed significantly with treatment 3 and 4. Feed intake increased with an increase in energy level from treatment 2 to treatments 4. The result of this study agree with that of (Mwale *et al*., 2008) who reported feed intake of broiler increased significantly (P<0.05) with age in all of the dietary energy levels tested, increase in feed intake as bird grew is due to the increasing demand for animal protein and energy needed for growth. The result also disagrees with the finding of Veld Kamp *et al*. (2005) who noted that feed intake decreases linearly as dietary energy increases. Also, Nahason *et al*. (2005) noted that as dietary energy increases, bird satisfy their energy needs by decreasing feed intake.

Average daily gain was lowest (31.89g) in T2 and highest (40.52g) in T4. Significant difference (P<0.05) exists across the treatments. Average daily gain was not significant (P>0.05) between T1, T3, T4, but differed significantly with treatment 2. Average daily gain increased with increase in age, which is in line with the findings of (Mwale *et al*., 2008), who reported that a reduction in dietary energy around 100 kcal/kg did not affect the growth performance during the whole grow out periods. The result of the present study also did not tally with that (Mwale *et al*., 2008) indicated that a reduction of dietary energy by 75 kcal/kg had a negative influence on average daily gain during the whole grow out period, which could be a combination effect from changes in dietary energy level. However, the result also is not in line with the finding of Sa'adu *et al*. (2018) who reported non-significant difference in average daily gain of broilers fed dietary energy levels at the finisher phase.

Result of feed conversion ratio (FCR) showed significant difference (P<0.05) across the

treatments with the T2 (2900kcal/kg) having (1.76) as the highest value and T3 (3000kcal/kg) with (1.42) as the lowest value. However, T3 differ from T1, T2, and T4 statistically. FCR did not follow the normal trend, as the energy increased, FCR increased from T1 to T4 except in T3, which had a sharp decline and was observed to have the best FCR, the lower the FCR, the better it is. The findings of this research agree with those of Mwale *et al*. (2008), who reported that a reduction in dietary energy around 100 kcal/kg did not affect the growth performance during the whole grow out periods. The result of the present study also did not tally with that of Mwale *et al*. (2008), which indicated that a reduction of dietary energy by 75 kcal/kg had a negative influence on feed conversion ratio during the whole grow out period, which could be a combination effect from changes in dietary energy level. However, the result also is not in line with the finding of Sa'adu *et al*. (2018) who reported a non-significant difference in average feed conversion ratio of broilers fed dietary energy levels at finisher phase.

Similarly, the result also showed that water intake was highest (243.17mls) in treatment 3 (3000kcal/kg) and was lowest (231.42mls) in treatment 1 (2800kcal/kg). Water intake was not significant (P<0.05) in all of the treatments. The differences observed were only numeric. However, the trend showed that water intake increased with an increase in energy level from T1 to T3, but declined in T4, which is not in line with the recommendations of Oluyemi and Roberts (2000) which stated that there is a significant correlation between feed intake and water intake of broiler birds.

Mortality observed in the experimental broiler chickens, the result shows the highest value in treatment 1 (2800kcal/kg) (30.77%) and the lowest value in treatment 2 (2900kcal/kg) (3.03%). There were significant differences (P<0.05) among all the treatments. Statistically T2, T3 were not significantly (P>0.05) different but T1 T4 differ significantly (P<0.05). Mortality in T1 was high but decreased in T2 and increased with increased energy level from T2 to T4. This could be due to genetics as birds are constantly bred so as their diet constantly change, which tally with the finding of this research tally with that of Sa'adu *et al*. (2018) who reported significant difference in mortality of broiler strain fed low, medium and high energy diet in 3 season (hot, cold and raining) at finisher phase, with birds fed medium energy having the highest percent mortality.

However, the result on cost of feed indicated that cost of feed was highest (167.79Naira/kg) in treatment 4 and was lowest (149.36Naira/kg) in T1. Significant difference (P<0.05) exists across the treatments. Treatment 4 was significantly (P<0.05) different, but T1, T2, T3 are similar statistically. Cost of feed increased with the increase in nutrients (energy levels). These findings are in line with that of Pym (2009) and that of Adeoti, and Olawuni (2013), that showed an increase in the cost of feed of the birds as the protein and content of the diet increased.

Result showed that feed cost per kilogram weight gain (Naira) was highest (280.21Naira) in T4 (3100kcal/kg) and was lowest (225.65Naira) in T3 (3000kcal/kg). Significant difference (P<0.05) was observed across the treatments. Statistically, feed cost per kilogram weight gain (Naira) was only significantly different (P<0.05) between T1, T3 and T2, T4, but T1 and T3 are similar, T2 and T4 are also similar. Feed cost per kilogram weight gain (Naira) increased with an increase in feed conversion ratio, which agrees with that of Mwale *et al*. (2008) who reported that an increase in feed conversion ratio increased feed cost per kilogram weight gain. The result also tallies with the finding of Nworgu *et al*. (2007) who also reported a significant difference in feed cost per kilogram weight gain at finisher phase during late dry season in broilers fed fluted pumpkin (*Telfaria occidentale*) leaves extracted supplement.

Table 2: Effect of dietary energy on growth performance parameters of broiler at finisher phase in hot dry period of semi-arid environment

Parameters	T1 (2800kcal/kg)	T2 (2900kca/kg)	T3 (3000kcal/kg)	T4 (3100kcal/kg)	SEM
Feed intake(g/b/d)	56.23^{c}	56.07^{c}	61.49^{b}	67.71^{a}	1.25
Average daily gain(g/b/d)	37.31^{a}	31.89^{b}	43.16^{a}	40.52^{a}	2.05
Feed conversion ratio	1.51^{a}	1.76^{a}	1.42^{b}	1.67^{a}	0.11
Water intake (mls/b/d)	231.42	231.92	243.17	233.75	4..31
Mortality (%)	30.77^{b}	3.03^{c}	6.06^{c}	13.33^{a}	6.23
Cost of feed (N/kg)	149.36^{b}	157.19^{b}	158.65^{b}	167.79^{a}	1.07
Feed cost/kg weight gain(N)	225.53^{b}	276.65^{a}	225.28^{b}	280.21^{a}	3.04

abc=Means across the rows with different super script differ significantly(P<0.05) SEM=Standard error mean, g /b/d=gram per bird per day

CONCLUSION

Based on the result of this research, the result obtained for general performance shows that T3 and T4 (3000-3100 kcal/ME) should be fed to Marshall broiler strain at finisher phase for optimum or better performance during the hot dry period of semi-arid Sokoto. It is recommended that further studies should be carried out in the differences of 200kcal of energy for more differences.

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