



GROWTH PERFORMANCE OF BROILER CHICKENS FED DIFFERENT DIETARY ENERGY SOURCES

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ABSTRACT

An experiment was conducted to evaluate the performance of broilers fed diets containing different energy sources. Five diets containing maize, red sorghum, white sorghum, Gero millet and Dauro millet were formulated and designated as diets 1, 2, 3, 4, and 5 respectively. Two hundred and Ten (210) day old Marshall Breed of broiler chicks were randomly allotted to five dietary treatments in a completely randomized design and each of the treatment replicated three times. Feed and water were provided ad libitum and the feeding trial lasted for eight weeks. At the starter phase, daily feed intake (33.05-47.52g ;), daily weight gain (9.74-19.43g ;) and feed conversion ratio (2.46-3.43) were significantly ($P < 0.001-0.05$) affected by the dietary treatments. At the finisher phase, daily weight gain (27.20-45.80g) was significantly ($P < 0.001$) influenced while daily feed intake and feed conversion did not differ significantly. The overall performance revealed that, daily weight gain and feed conversion ratio were significantly ($P < 0.001-0.05$) affected, however, daily feed intake was not influenced by the dietary treatments. It is therefore concluded that millet and dauro can effectively replace the most widely used maize in feed formulation, this is because of their lower feed conversion ratio. It is therefore recommended that farmers should use either ordinary millet or dauro in compounding diets for their broiler chickens.

Keywords: Growth, Performance, Broiler-chickens, Dietary, Energy, Sources.

INTRODUCTION

The energy portions of poultry diets represent the largest single dietary ingredient. Maize which used to be the major source of energy in poultry diet is now very expensive due to low production in drier areas of tropics and the intense competition between man and livestock. Presently maize production is growing only at 3-4% per annum leaving a gap to be filled by alternative sources. One important measure that can be taken to alleviate this situation is the use of alternative energy sources like the sorghum and millet which are produced extensively in the semi-arid areas. Travis *et al.* (2006) reported that sorghum grains can play an important role in poultry feed in sahelian countries. Other workers Hancock (2000), Dowling *et al.* (2002), Cramer *et al.* (2003) have shown that sorghum could be a suitable feed stuff in poultry industry. Preliminary studies have shown that under tropical conditions, sorghum can replace up to 60% of maize in the broiler diets and 50-100% of maize in the layer chickens without any adverse effects on the performance (Adamu *et al.* (2004) on the other hand exonerated millet from anti nutritional properties (*phytate* and *tannin*) found in sorghum. NRC 2014) reported that millet has no tannin but contain 5-7% oil and higher protein and minerals than maize.

The report further reveals that millet can replace maize in the diet of broiler chicken without adverse effect on the growth performance or feed conversion ratio. Incorporation of millet in place of maize can reduce the dependency on maize and also the cost of poultry production. The metabolizable energy of millet reported in the literature (3,024 kcal/kg) was lower than that of maize (Mustapha and Doma (2012). The protein in millet is well balanced in amino acids in practical poultry diets. Maize which is the most widely conventional source of energy used in poultry feed is becoming expensive especially to small scale poultry farmers in Nigeria. The increase in price of maize is attributed to its declining production condition coupled with stiff competition for its use by man and other livestock species (Agbede *et al.*, 2002; Hamzat *et al.*, 2003). This high demand for feedstuff by man and consequently high price has made the use of other alternative energy sources like sorghum and millet inevitable.



This study was therefore conceived to evaluate the following growth Performance (Weight gain, Feed intake, and Feed conversion ratio) of broiler chickens fed different dietary energy sources.

MATERIALS AND METHODS

Experimental Site

The experiment was conducted at the Poultry Unit of the Teaching and Research Farm, Abubakar Tafawa Balewa University, Bauchi, Nigeria. The State shares boundary with Yobe to the North, Jigawa to the North-West, Kano to the West, Plateau, Taraba to the South and Gombe to the East. The State has a total land mass of about 49119 square metres, which represents about 5.3% out of Nigeria's total land mass 909,890 square metres (NBS, 2010). The State lies between longitude 8° 50' 11" East of the Greenwich meridian and latitude 9° 3' to 12° 3' North at an altitude of 600 meters above sea level.

Mean daily temperature ranges from 29.2°C in July and August to 37.6°C in March and April; from 11.7°C in December and January to about 24.7°C in April and May. Sunshine hours range from 5.1 hours in July to about 8.9 hours in November, with October and February recording the highest sunshine. Humidity ranges from 12% in February to 68% in August, and the rainy season months are May to September when humidity ranges from 37-68%, the total annual mean rainfall ranges from 700 mm in the northwest, 1000 mm in the central and northeast and 1600 mm in the southern part. Onset of the rain is often in March which ends virtually by October. Radiation is fairly even throughout the year, varying from 11.3 mm in July to about 18.7 mm in April. However, it is relatively high in March, April and May, which is generally between 16.1 mm and 18.7 mm. Similarly, evaporation ranges from 2.4 mm in July and August to 1.57 mm in March, the month of January and April has been the greatest period of evaporation.

Management of the Experimental Birds

Two hundred and ten (210) day old marsh breed of broiler chicks were obtained from Agrited, the chicks were brooded for a period of one week on deep litter. They were fed *ad libitum* on commercial diet throughout the brooding period. Two weeks before the arrival of the chicks the experimental pen was thoroughly washed, cleaned, disinfected and dried. A week prior to the arrival of the birds' wood shavings were spread to the required length on the floor, electrical appliances, feeders; drinkers were all put in place and the electrical appliances. Upon the arrival of the chicks brooding commenced at once, heat was provided by the use of 200W electric bulb, kerosene stove and charcoal were made available in case of power failure to provide heat intermittently. Water and feed were supplied *ad libitum* during the whole period of the trial. Routine management, vaccines and medications were administered according to the methods of (Oluyemi and Roberts, 2007).

Experimental Diets

Five diets containing different energy sources with maize as control were formulated; other diets consist of two varieties of Sorghum (Red and White), Millet (*Gero and Dauro*). The diets were designated as 1,2,3,4 and 5, respectively. Maize, Sorghum and Millets were the principal sources of energy while major sources of protein in the diet were roasted full fat soya beans and fish meal. The diets were formulated to supply approximately 3000 kcal/kg ME, 23% and 20% crude protein for both starter and finisher diets, respectively, methionine and lysine were used as supplements in the diets. The ingredients, chemical composition and calculated analysis of the experimental diets for both starter and finisher phases are shown in Tables 1 and 2, respectively.



Table 1: Ingredients and Proximate Composition (%) of Diets Containing Different Energy Sources at the Starter Phase (1-4weeks)

Ingredients	1	2	3	4	5
Maize	43.33	-	-	-	-
Red sorghum	-	46.88	-	-	-
White sorghum	-	-	46.88	-	-
Gero millet	-	-	-	45.15	-
Dauro millet	-	-	-	-	45.15
Soyabeans	35.47	32.12	32.12	33.85	33.85
Wheat offal	12.00	12.00	12.00	12.00	12.00
Fish meal	5.00	5.00	5.00	5.00	5.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Limestone	1.00	1.00	1.00	1.00	1.00
Methionine	0.30	0.30	0.30	0.30	0.30
Lysine	0.20	0.20	0.20	0.20	0.20
Salt	0.25	0.25	0.25	0.25	0.25
Premix*	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100
Calculated Analysis					
Crude protein (%)	23.00	23.00	23.00	23.00	23.00
ME (kcal/kg)	3087	3029	3029	2849	2849
Calcium (%)	1.35	1.36	1.36	1.35	1.35
Phosphorous (%)	0.85	0.94	0.94	0.84	0.84
Ether extract (%)	8.96	8.04	8.04	8.80	8.80
Crude fibre (%)	4.10	4.11	4.11	3.92	3.92

*Broiler Starter premixes a product of Pfizer Nigeria limited. Supplied per kg diet; Vit A, 7000 iu, Vit D3 1500iu, Vit E 3iu, Vit K 2mg, riboflavin 500mg, folic acid 60mg, Niacin 15mg, Chlorin 5mg, Vit B12 0.08mg, folic acid 4mg, Mn 8mg, Zn 0.5mg, Iodine 0.1mg, Co 1.2mg, Cu10mg, Fe 20mg.

Table 2: Ingredients and Proximate Composition (%) of Diets Containing Different Energy Sources at the Finisher Phase (5-8 weeks)

Ingredients	Diets				
	1	2	3	4	5
Maize	54.26	-	-	-	-
Red sorghum	-	58.43	-	-	-
White sorghum	-	-	58.43	-	-
Gero millet	-	-	-	56.27	-
Dauro millet	-	-	-	-	56.27
Soyabeans	24.74	20.57	20.57	22.73	22.73
Wheat offal	12.00	12.00	12.00	12.00	12.00
Fish meal	5.00	5.00	5.00	5.00	5.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Limestone	1.00	1.00	1.00	1.00	1.00
Methionine	0.30	0.30	0.30	0.30	0.30
Lysine	0.20	0.20	0.20	0.20	0.20
Salt	0.25	0.25	0.25	0.25	0.25
Premix*	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100



Calculated Nutrient

Nutrient Composition	Diet I	Diet II	Diet III	Diet IV	Diet V
Crude Protein (%)	20.00	20.00	20.00	20.00	20.00
Metabolizable Energy (kcal/kg)	3101	3029	3029	2804	2804
Calcium (%)	1.47	1.73	1.73	1.48	1.48
Phosphorus (%)	0.79	0.90	0.90	0.79	0.79
Ether Extract (%)	7.50	6.30	6.30	7.20	7.20
Crude Fibre (%)	3.70	3.72	3.72	3.51	3.51

*Broiler Starter premixes a product of Pfizer Nigeria limited. Supplied per kg diet; Vit A, 7000 iu, Vit D3 1500iu, Vit E 3iu, Vit K 2mg, riboflavin 500mg, folic acid 60mg, Niacin 15mg, Chlorin 5mg, Vit B12 0.08mg, folic acid 4mg, Mn 8mg, Zn 0.5mg, Iodine 0.1mg, Co 1.2mg, Cu 10mg, Fe 20mg.

Experimental Design

After the brooding period of about one week the birds were randomly allotted to five dietary treatments with 42 birds per treatment and each treatment was replicated three times with 14 birds per replicate, and laid out in a completely randomised design (CRD). The birds were fed the experimental diets for four weeks during the starter phase and four weeks during the finisher phase.

Data Collection

Feed intake

Feed given to the birds were weighed for each treatment and replication and the left over collected were weighed before the next feeding. Daily feed consumption was computed for each treatment by dividing the total amount of feed consumed by the number of live birds. These figures were recorded as the daily feed intake of the birds.

Weight gain

The birds were weighed on weekly basis to observe changes in their body weight using weighing scale. The body weight gains were computed by difference for each replicate.

Feed conversion ratio

This is computed by using the mathematical relation below.

$$\text{FCR} = \text{Feed Intake/weight gain} \times 100/1$$

Mortality

Mortalities were recorded for each replicate. At the end of the experiment percentage mortalities were computed for each group by using the simple mathematical relation below.

$$\% \text{ Mortality} = \text{Number death birds/Number of birds per pen} \times 100/1$$

Statistical Analysis

All the data generated during the experiment for all the parameters studied were subjected to analysis of variance technique as outline by (Steel and Torrie, 1980) using SPSS version 2024. The differences between the treatment means were further separated using Duncan's Multiple Range Test (DMRT) (Duncan, 1955)

RESULTS AND DISCUSSION

Growth Performance of Broiler Chickens Fed Different Energy Sources at the Starter Phase (1-4 weeks)

The result as presented in Table revealed a significant ($P < 0.05$) difference among the experiment diets during the starter phase. The result further showed that, highest feed consumption value of 47.52g was obtained in birds fed diet 5 (*Dauro* millet) which was closely followed by the intake on diet 2. However, the feed intake on diet 1 (control), 3 and 4 were similar. The result also indicated a significant ($P < 0.001$) difference in the daily weight gain of the chicks at the end of the starter phase. The highest gain of 19.43g was recorded among the birds fed diet 5 (*Dauro* millet-based diet), while the lowest weight gain of 9.74g was recorded among the birds fed diet 3 (white sorghum based diet). However, chicks fed diets 1 (control), 2 and 4 have similar daily Weight gains. Feed conversion on the other hand, the result showed a significant ($P < 0.05$) difference among the chicks at the end of the starter phase. The highest feed conversion ratio of 3.43 was recorded among the birds fed diet 3



(white sorghum based diet) which is similar to diet 2 and closely followed by birds on diet 1 (control), while the lowest feed conversion was recorded in diet 5 (*Dauro* millet based diet), which is also similar to 1(control) and diet 4. The significant difference observed is similar to the findings of Musa et al (2002), who reported a higher feed intake in millet based diets, the result obtained also corroborate with the findings of Juma and Garba (2012, and Maijamaa et al 2011, The higher weight gain obtained at the starter phase (19.43g) was similar to that of Musa et al (2002), who reported a weight gain of (20.30), the result is also similar to the findings of Adamu et al (2010) who reported a value of (20.24g). Also the significant difference observed in the feed conversion ratio were *Daura*, and millet based diets have a lower feed conversion ratio is in agreement with the findings of Mustapha and Aliyu (2001), and that of Benjamin and George (2005), who reported a feed conversion ratio of 2.10g and 2.00g for *dauro* and millet based diets respectively.

Table 3: Performance Characteristics of Broilers Fed Diets Containing Different Energy Sources (1-4 weeks)

Parameters	1	2	3	4	5	SEM
Daily feed intake (g)	37.64 ^b	41.29 ^b	33.05 ^c	36.76 ^b	47.52 ^a	1.36*
Daily weight gain (g)	12.68 ^b	12.92 ^b	9.74 ^c	13.52 ^b	19.43 ^a	0.37***
Feed conversion ratio	2.98 ^{ab}	3.19 ^a	3.43 ^a	2.72 ^{ab}	2.46 ^b	0.12*
Mortality (Number)	3	1	0	0	2	-

a,b,c Means in the same row with different superscripts are significantly different;

(*= $P < 0.05$; ***= $P < 0.001$), SEM= Standard error of the mean

The result in Table also showed that, mortality observed at the starter phases ranged from 1-3 on diets 2 and 1 respectively. However, there was no mortality on diets 3 and 4.

Growth Performance of Broiler Chickens Fed Different Energy Sources at the Finisher Phase (5-8 weeks)

The result as presented in Table 4 revealed that, daily feed intake at the finisher phase ranged from 86.21-118.87g. However, no significant difference was observed across the dietary treatments. Daily weight gain on the other hand, a significant ($P < 0.001$) difference was observed for daily weight gain of the birds at the end of the finisher phase (Table 4). The highest weight gain of 45.08g was recorded among the birds fed diet 5 (*Dauro* millet based diet), while the lowest weight gain of 27.20g was recorded on those fed diet 3 (white sorghum based diet) which was similar to the gains on diets 1(control), 2 and 4. Study on feed conversion ratio showed no significant difference was observed across the dietary treatments at the end of the finisher phase. However, birds on diet 1 (control) recorded the highest feed conversion ratio while those on diet 4 (*Gero* millet-based diet) recorded the lowest feed conversion ratio of 2.49. The mortality recorded in this phase of the experiment was low and within the acceptable range of 5%. The result obtained for daily feed intake at finisher phase (86.21g-118.87g) was similar to that of Yahaya and Domaa (2021) and that of Mustapha and Maijamaa (20003) who also reported a non-significant difference among the various treatments compared with millet..also Aliyu and Mohammed recorded a significant difference among the treatments compared for feed conversion ratio (FCR), this is not in agreement to what was obtained in this study which shows no significant difference among the treatments

Table 4: Performance Characteristics of Broilers Fed Diet Containing Different Energy Sources (5-8 weeks)

Parameters		Diets				SEM
	1	2	3	4	5	
Daily feed intake (g)	106.79	94.30	89.94	86.21	113.87	4.07 ^{NS}
Daily weight gain (g)	31.69 ^b	31.15 ^b	27.20 ^b	34.68 ^b	45.80 ^a	1.07 ^{***}
Feed conversion ratio	3.38	3.08	3.31	2.49	2.53	0.14 ^{NS}
Mortality (Number)	0	1	1	0	0	-

a,b, Means in the same row with different superscripts are significantly different (***=P<0.001). NS=not significant; SEM= Standard Error of the mean

Overall Performance of Broiler Chickens Fed Different Energy Sources (1-8 weeks)

The daily feed intake (Table 5) observed at this phase varied from (61.49-80.70g) on diets 4 and 5 respectively, were not significantly affected by the dietary treatments. The result further revealed a highly significant (P<0.001) difference on weight gain for birds at the overall phase. The highest weight gain of 32.26g was observed in birds fed diet 5 (*Dauro* millet-based diet) which was closely followed by birds on diet 4 (*Gero* millet-based diet), while the lowest weight gain was recorded in birds on diet 3 (white sorghum-based diet). However, the daily weight gain observed on diets 1 (control) and 2 were similar. Feed conversion ratio (1-8 weeks) on the other hand, a significant (P<0.05) difference was observed in the overall performance. The highest feed conversion of 3.37 was recorded in birds on diet 3 (white sorghum-based diet) which was similar to diet 1 (control) and 2, while the lowest feed conversion was observed in birds on diet 5 (*Dauro* millet-based diet) which was also similar to diet 4. Generally, the mortality observed at the overall performance ranged from 1-3 across the dietary treatments. The result for the overall performance shows that the lowest feed conversion ratio was recorded in diet five(5) and is similar to diet 4, which are *dauro* and millet based diets, the result is similar to that of Moses and hamman(2012) who reported a lower feed conversion ratio of 2.30, and Kawu and doma(2011) who reported a lower value of 19.20 feed conversion ratio in *dauro*.

Table 5: Performance Characteristics of Broilers Fed Diets Containing Different Energy Sources (1-8 weeks)

Parameters	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5	SEM
Daily feed intake (g)	72.23	67.80	61.50	61.49	80.70	2.64 ^{NS}
Daily weight gain (g)	22.18 ^{bc}	22.04 ^{bc}	18.47 ^c	23.95 ^b	32.26 ^a	0.62 ^{***}
Feed conversion ratio	3.18 ^a	3.14 ^a	3.37 ^a	2.60 ^b	2.49 ^b	0.11 [*]
Mortality (number)	3	2	1	1	2	—

a,b,c Means in the same row with different superscripts are significantly different (*=P<0.05, ***=P<0.001); NS=not significant; SEM= Standard Error of the mean

CONCLUSION AND RECOMMENDATION

Based on the result obtained it is therefore concluded that Birds fed *Dauro* millet-based diets performed better (80.70g) than those on the other cereals (72.23g, 62.80g, 61.50g and 61.49g) Based on the result of this study, birds on the diet containing *Dauro* millet gave the best performance (80.70g) it is therefore recommended that farmers should use *Dauro* as a substitute to maize because it gave the best performance.

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