



PERFORMANCE AND ECONOMIC BENEFITS OF BROILER CHICKEN PRODUCTION USING WHITE SORGHUM AS REPLACEMENT FOR MAIZE

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ABSTRACT

The study was conducted at the Teaching and Research Farm of the Abubakar Tafawa Balewa University Bauchi. Five diets were formulated in which white sorghum replaced maize at 0, 25, 50, 75 and 100 % in diets 1, 2, 3, 4 and 5 respectively. Two hundred (200) day old broiler chicks were used for the research. After brooding, the chicks were randomly allotted to the five diets in four replicates each with ten (10) chicks per replicate in a completely randomised design. Experimental feeds and water were supplied *ad libitum* and all other routine activities as well as vaccinations against New castle diseases were carried out according to schedule. Data on initial weights, daily feed intake and body weight changes were taken during the eight weeks' period of the feeding trial. Feed conversion ratio and feed efficiency were calculated from the relationships of feed intakes and weight gains. Data generated were subjected to analysis of variance. The results obtained showed no significant difference on all the performance parameter studied at both the starter and finisher phases. However, at starter phase, the highest initial body weight was found on diet (1264.59g) and the lowest was found on diet 5 (252.08g). Daily feed intake ranged from 74.48 g on diet 3 to 81.30 g on diet 5. Daily weight gain values ranged from 23.66g on diet 1 to 25.45g on diet 5. The feed conversion ratio ranged from 3.13 on diet 4 to 3.22 on diet 1. Similarly, in finisher phase. The final weight gain ranged from 1622.41 g on diet 4 to 1797.30 g on diet 2. The daily feed intake ranged between 23.38 g on diet 1 to 31.26 g on diet 2. The best feed conversion ratio was obtained on diet 3 (2.82) while the poorer was obtained on diet 4 (3.18). Numerical values for daily feed intake were between 78.32 g on diet 3 to 86.16 g on diet 5. Daily weight gain which ranged from 26.04g on diet 4 to 27.84 g on diet 2 are statistically similar. Feed conversion ratio ranged from 2.99 on diet 3 to 3.31 on diet 5. The lowest feed cost was found on diet 5 (₦ 305.61) and the highest on diet 3 (₦ 319.68). The highest total feed cost was found on diet 4 (₦ 1194.11) and the lowest on diet 5 (₦ 1289.66). Feed cost per kilogram gain was higher on diet 5 (₦ 969.67) and the lowest on diet 1 (₦ 923.38). It was concluded that white sorghum can completely replace maize in broiler chicken diets without affecting the general performance of the birds. It is therefore recommended for use in broiler chicken diets.

Keywords: Chicks, Broiler, Sorghum, Performance, Economic, Benefits.

INTRODUCTION

Feed cost remain the most challenging factor in livestock business world over. Maize is the mainstay source of energy in sub Saharan African countries including Nigeria, in commercial broiler rations, and contributes more than 60% of the ration in diets of monogastric animals (Jama'a, *et al.* 2024). Maize is also a staple feed for most people in Nigeria and its use as animal feed create a competition that inflate price in the market. As a result, commercial and subsistence poultry farmers encounter high feed costs resulting in unprofitable business. Thus, to reduce feed cost and increase profit margin, formulating feed using cheap and locally available ingredients like sorghum is essential. Tamburawa *et al.* (2012) also suggested that increase in prices of maize necessitates the use of other energy sources such as sorghum and millet in order to reduce the cost of production. Sorghum (*Sorghum bicolor*) is abundant in most parts of Nigeria and is among the main cereal crops because of its tolerance to harsh climatic conditions. Sorghum has a similar energy value to maize therefore it can be used as an energy source in broiler feed (Hidayat *et al.*, 2022). Etuk *et al.* (2012) stated that compared to maize sorghum has a higher protein content, but conversely, the energy and fat contents of maize are relatively



higher than sorghum, while the amino acid contents in sorghum are comparable to maize. The lysine digestibility of sorghum has been reported to be similar to that of maize (Da silva *et al.*, 2018). However, different studies by Osman and Grassem, 2013 and Mohammed *et al.*, 2019 have found that body weight decreased significantly in chickens fed sorghum-based diets. The negative effects of sorghum in animal performance are understood to come from anti-nutritional factors (ANFs) such as tannin, kafrin and phytate that affect efficient nutrients utilisation and metabolism (Hamid *et al.*, 2017). Consequently, with selection of good varieties and proper processing sorghum could play an important part in diets fed to livestock and poultry in West Africa.

METHODOLOGY

Study Location

The experiment was conducted at the poultry units of Teaching and Research Farm of the Department of Animal Production, Abubakar Tafawa Balewa University Bauchi, Bauchi State during the months of May and July 2023. Bauchi lies between longitude 10⁰10¹ to 30¹N and latitude 9041 and 10⁰ 31¹E at an altitude of 6902 meters above sea level (BSADP, 2015).

Experimental Diets

Five diets at both starter and finisher phase were formulated with 23% and 20% crude protein respectively. White sorghum replaced maize at 0%, 25%, 50%, 75% and 100% levels in the diets and were designated as treatments 1, 2, 3, 4 and 5. (Table 1 and 2)

Experimental Birds and their Management

A total of 200-day-old broiler chicks were purchased from a reputable source and used for the experiment. Before their arrival, brooding room was thoroughly cleaned and disinfected with the floor covered with wood shavings. Heat was provided using charcoal and kerosine stove. Anti – stress was given in their drinking water the first day and there after feed and fresh water were supplied *ad-libitum*. After seven days brooding, the birds were randomly allotted to the five (5) diets. Each treatment was replicated four times with ten (10) chicks per replicate in a completely randomised design. The feeding trial lasted for eight (8) weeks with four weeks each of starter and finisher phases. Fresh drinking water and feeds were given *ad-libitum*. All vaccinations and other routine activities were carried out at their appropriate times.

Data Collection

Initial weights of birds in each replicate were recorded at the beginning of the feeding trial, feed intakes and body weight changes were taken on daily and weekly basis respectively. Feed Conversion Ratio and Feed efficiency were calculated from the relationships of feed intakes body weight gains across the treatments. Cost and quantity of each ingredient used were recorded and from which economic benefits using feed cost per naira (kg) and total feed cost per kg gain.

Data Analysis

Data generated were subjected to analysis of variance using MINITAB 17 VERSION and where significant differences exist among the means, Duncan Multiple Range Test was used to separate them.



Table 1: Proximate Composition of Experimental Diets at Stater Phase (2- 5 weeks)

Ingredients	D1(0%)	D2(25%)	D3(50%)	D4(75%)	D5(100%)
White maize	50.64	37.98	25.32	12.66	0.00
White sorghum	0.00	12.60	25.32	37.98	50.64
Full fat soyabean	30.66	30.66	30.66	30.66	30.66
Wheat offal	10.00	10.00	10.00	10.00	10.00
Fish meal	5.00	5.00	5.00	5.00	5.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Lime stone	1.00	1.00	1.00	1.00	1.00
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10
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 (%)					
Crud Protein (%)	23.00	23.00	23.00	23.00	23.00
ME (Kcal/kg)	2808.48	2791.77	2775.06	2758.35	2743.29
Crude Fiber (%)	3.91	3.91	3.91	3.91	3.91
Calcium (%)	1.31	1.39	1.39	1.39	1.39
Phosphorus (%)	0.71	0.74	0.77	0.79	0.83
Lysine (%)	1.30	1.31	1.33	1.34	1.35
Methionine (%)	0.39	0.38	0.37	0.36	0.35

Table 2: Proximate Compositions of Experimental Diets at Finisher Phase (5-8 weeks)

Ingredients	D1 (0%)	D2(25%)	D3(50%)	D4(75%)	D5(100%)
White maize	54.95	41.21	27.47	13.74	0.00
White sorghum	0.00	13.74	27.47	41.21	54.95
Full fat soyabean	25.15	25.15	25.15	25.15	25.15
Wheat offal	12.00	12.00	12.00	12.00	12.00
Fish meal	3.00	3.00	3.00	3.00	3.00
Bone meal	2.50	2.50	2.50	2.50	2.50
Lime stone	1.50	1.50	1.50	1.50	1.50
Salt	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25
Lysine	0.20	0.20	0.20	0.20	0.20
Premix	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100
Calculated Analysis					
ME (Kcal/kg)	2804.71	2786.58	2768.11	2750.32	2732.18
Crude protein (%)	20.00	20.00	20.00	20.00	20.00
Crude fiber (%)	3.78	3.78	3.78	3.78	3.78
Calcium (%)	1.25	1.25	1.25	1.26	1.27
phosphorus (%)	0.73	0.76	0.79	0.72	0.75
lysine (%)	1.08	1.09	1.11	1.13	1.12
Methionine	0.33	0.32	0.31	0.29	0.29

Table 3: Percentage Proximate Compositions of the Experimental Diets (starter)

Sample Description	D₁	D₂	D₃	D₄	D₅
DM%	89.70	90.12	90.35	90.58	89.58
Ash%	9.89	10.75	10.81	11.22	11.75
CP%	22.54	23.02	23.16	23.11	22.63
EE%	8.54	8.69	8.89	8.98	8.59
CF%	6.49	6.23	6.19	6.13	6.32



Table 4: Percentage Proximate Compositions of the Experimental Diets (finisher)

Sample Description	D ₁	D ₂	D ₃	D ₄	D ₅
DM%	89.56	90.16	89.11	88.66	88.61
Ash%	7.29	7.16	6.63	6.58	6.89
CP%	19.49	19.51	18.84	20.13	19.52
EE%	7.53	6.89	7.11	7.29	7.23
CF%	5.41	5.40	5.49	5.30	5.35

Table 5: Percentage Proximate Compositions of the Test Material (White Sorghum)

DM	Ash	CP	EE	CF
89.74	1.72	11.39	1.83	2.34

RESULTS AND DISCUSSION

Performance of Broiler Chickens Fed Graded Levels of White Sorghum as Replacement for Maize

All the growth performance parameters (feed intake, body weight gain, feed conversion ratio and feed efficiency) did not show any statistical significance. This finding did not agree with that of Jama'a *et al.* (2024) who reported high significance on the growth performance parameters after feeding broiler chickens with ICSV400 sorghum variety as replacement for maize. However, at starter phase, the highest initial body weight was found on diet 1(264.59g) and the lowest was found on diet 5 (252.08g). Daily feed intake ranged from 74.48 g on diet 3 to 81.30 g on diet 5. The higher feed intake obtained on diet 5 could be attributed to low energy level in white sorghum. According to Yasin (2022) broiler chickens consume more feed to satisfy their energy requirement as energy level of feed was the major factor influencing feed intake in broiler chickens. Daily weight gain values ranged from 23.66g on diet 1 to 25.45g on diet 5. This result agreed with findings of Selle *et al.* (2021) who reported that broiler chickens fed local white sorghum had a better weight gain. The feed conversion ratio ranged from 3.13 on diet 4 to 3.22 on diet 1, Medugu *et al.* (2010) obtained a lower result (2.24 – 2.94) of feed conversion in broiler chickens. Similarly, there were no significant differences in all the parameters measured in finisher phase. The final weight gain ranged from 1622.41 g on diet 4 to 1797.30 g on diet 2. These values were higher than (1340 g -1474g) reported by Issa *et al.* (2015). The daily feed intake ranged between 123.38 g on diet 1 to 131.26 g on diet2. The best feed conversion ratio was obtained on diet 3 (2.83) while the poorer was obtained on diet 4 (3.18). Numerical values for daily feed intake were between 78.32 g on diet 3 to 86.16 g on diet 5. These values were lower than 80.56 g - 97.01 g reported by Muhammad *et al.* (2015). Daily weight gain which ranged from 26.04g on diet 4 to 27.84 g on diet 2 are statistically similar. Feed conversion ratio ranged from 2.99 on diet 3 to 3.31 on diet 5.

The lowest feed cost was found on diet 5 (₦ 305.61) and the highest on diet 3 (₦ 319.68). The lowest total feed cost was found on diet 4 (₦ 1194.11) and the highest on diet 5 (₦ 1289.66). However, feed cost per kilogram gain was higher on diet 5 (₦ 969.67) and the lowest on diet 1 (₦ 923.38). These results do not agree with the reports of many researchers (Ibitoye *et al.* (2012); Etuk *et al.* (2012); Adamu *et al.* (2013); Aladeen *et al.* (2013) Doma, U. D. (2021)) who reported significant reduction of cost of production when sorghum completely replaced maize in broiler chicken diets.



Table 6: Performance of Broiler Chickens Fed Graded Levels of White Sorghum as Replacement for Maize

Parameter	Diets (%)					SEM
	1(0)	2(25)	3(50)	4(75)	5(100)	
Starter phase (2-5 weeks)						
Initial weight(g)	264.59	262.50	259.38	260.41	252.08	5.32 ^{NS}
Daily feed intake (g)	75.97	79.58	74.48	77.53	81.03	2.22 ^{NS}
Daily weight gain (g)	23.66	24.41	23.77	24.78	25.45	0.93 ^{NS}
Feed conversion ratio	3.22	3.26	3.14	3.13	3.21	0.08 ^{NS}
Feed efficiency	0.31	0.31	0.32	0.32	0.32	7.95 ^{NS}
Mortality (Number)	0.00	0.00	0.00	0.00	0.00	-
Finisher phase (5-8weeks)						
Initial weight gain (g)	662.50	683.33	665.61	697.92	912.50	26.06 ^{NS}
Final weight gain (g)	1685.9	1797.30	1720.00	1622.41	1747.10	47.69 ^{NS}
Daily feed intake (g)	123.38	131.26	129.05	127.30	128.99	4.57 ^{NS}
Daily weight gain (g)	47.32	48.83	47.54	49.56	50.90	4.57 ^{NS}
Feed conversion ratio	2.92	2.91	2.83	3.18	3.41	0.40 ^{NS}
Feed efficiency	0.36	0.36	0.36	0.33	0.32	0.03 ^{NS}
Mortality (Number)	1.25	2.00	3.00	1.00	1.75	0.44 ^{NS}
Overall phase (1-8 weeks)						
Daily feed intake (g)	81.23	83.34	78.32	79.43	86.16	2.32 ^{NS}
Daily weight gain (g)	27.27	27.84	26.41	26.04	27.22	1.94 ^{NS}
Feed conversion ratio	3.07	3.08	2.99	3.16	3.31	0.22 ^{NS}
Feed efficiency	0.34	0.34	0.34	0.33	0.32	0.02 ^{NS}

Ns=Not significant, SEM=Standard error of the mean,

Table 8: Economic Benefits of Broiler Production Using White Sorghum to Replace Maize (2-8 weeks)

Parameters	Diets				
	1	2	3	4	5
Total feed intake (kg)	3.98	4.08	3.84	3.89	4.22
Feed cost (₦/kg)	310.89	309.78	319.68	306.97	305.61
Total feed cost (₦)	1237.34	1263.90	1227.57	1194.11	1289.66
Total weight gain (kg)	1.34	1.36	1.27	1.28	1.33
Feed cost per kg gain (₦)	923.38	929.34	951.60	932.90	969.67

CONCLUSION AND RECOMMENDATION

It was concluded that white sorghum can completely replace maize in broiler chicken diets without any negative effects on the general performance of the birds and it is recommended for use in broiler chicken's diet.

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