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Effect of replacement of sorghum *SK–5912* for dietary maize on performance and economics of production of broiler chickens

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Target Audience: Poultry Farmers, Animal Scientists, Poultry Feed Manufacturers.

Abstract

An experiment was conducted to evaluate the performance and economic value of sorghum SK-5912 as replacement for maize in broiler diets at varying dietary levels. Five diets were formulated in which sorghum SK-5912 replaced maize at 0, 25, 50, 75 and 100% levels coded as diets 1 (control), 2, 3, 4 and 5 respectively for starter (23% CP) and finisher (20%) rations using boiled soya bean as source of plant protein. Three hundred broiler Marshal" chicks were randomly allotted to the dietary treatments with four replications of fifteen birds per replicate in a completely randomized design (CRD). Feed and water were supplied ad libitum and experiment lasted for a period of eight weeks. Results revealed that daily feed intake, daily weight gain and feed conversion ratio were not significantly influenced by the dietary levels of sorghum SK-5912 as replacement for maize at the starter, finisher as well as the overall phases. The economics of production indicated that diet 5 (100% sorghum SK-5912) had the cheapest feed cost ₦/kg gain of ₦310.17 while the highest was diet 1 (₦347.70). It can therefore, be concluded that sorghum SK-5912 variety can replace maize at 100% in the diets of broiler chickens without detrimental effects on performance and with concomitant reduction in feed cost.

Keywords: Broiler, Diet, Economic, Performance, Production, Sorghum *SK - 5912*

Description of Problem

The major source of energy in poultry diet is maize. Production of this cereal grain and the intense competition between man and livestock especially in the drier areas of the tropics for maize has made poultry rations to be expensive, [1]. Several attempts at reducing this high cost of feed continue with the search for useful alternatives that are readily available, comparatively lower prices due to low human demand, [2]. Among the possible alternative to maize in Nigeria is sorghum which is readily available and cheaper than maize in the Northern part of the country [3]. Among the different varieties of sorghum developed in the country sorghum *SK- 5912* is widely cultivated in the semi arid regions of Nigeria but with low human demand despite its numerous qualities. The sorghum *SK-5912* is yellow in colour, high yielding, drought resistant, tolerant to striga and has relatively low tannin content. The variety *SK-5912* had poor taste when prepared as Tuwo, the traditional stiff porridge, unacceptable black colour and overnight keeping quality [4]. Its attractive yellow colour could be an indication of the presence of phyto-nutrients, such as carotenoids, which are important precursors of retinol (Vitamin A). Sorghum *SK-5912* was used in a trial, and the result showed that it can conveniently replace maize as dietary energy sources in turkey starter diets [5] and local

grower turkeys [2]. Hence, there is need to determine the effect of graded levels of sorghum *SK-5912* on the performance of broiler chickens. This study therefore was conceived to investigate the performance and economic potential of broiler chickens fed sorghum *SK-5912* as replacement for maize.

Materials and Methods

A total of three hundred experimental birds were randomly allotted to five experimental treatments that were replicated four times of fifteen birds per replicate in a completely randomized design (CRD). Feed and water were supplied to them *ad libitum* during the experiment which lasted for eight weeks. Five experimental diets for both starter and finisher phases were formulated in which sorghum *SK-5912* replaced maize at 0, 25, 50, 75 and 100% levels of inclusion coded as diets 1, 2, 3, 4 and 5 respectively (Tables 1 and 2). Samples of sorghum were analyzed to determine their proximate composition according to [6]. Body weight, feed consumption and feed conversion ratio were measured as the indices of performance and cost per kilogram of feed and feed cost per kilogram of weight gain were calculated to indicate the economics of production sorghum *SK-5912* replacing maize as dietary energy sources. Data collected were subjected to Analyses of Variance (ANOVA) technique as described by [7], using Minitab software statistical package [8]. Differences between treatment means were separated using Duncan's Multiple Range Test [9].

Table 1: Percentage composition of graded levels of Sorghum *SK-5912* as replacement for maize in broiler starter diets (1-4 weeks)

	Diets				
Ingredients	**1 (0%)**	**2 (25%)**	**3 (50%)**	**4 (75%)**	**5 (100%)**
Maize	48.55	36.41	24.28	12.14	0.00
Sorghum (*SK-5912*)	0.00	12.14	24.28	36.41	48.55
Boiled Soya bean	33.65	33.65	33.65	33.65	33.65
Wheat offal	10.00	10.00	10.00	10.00	10.00
Fish meal	4.00	4.00	4.00	4.00	4.00
Bone meal	3.00	3.00	3.00	3.00	3.00
+Premix	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.20	0.20	0.20	0.20	0.20
Total	100	100	100	100	100
Calculated Analysis					
Crude protein (%)	22.50	22.75	23.00	23.50	24.00
ME (Kcal/kg)	2950	2900	2800	2750	2700
Crude fibre (%)	4.00	4.00	4.00	3.80	3.80
Ca (%)	1.44	1.45	1.45	1.46	1.46
P (%)	0.74	0.77	0.80	0.82	0.86
Lysine (%)	1.20	1.21	1.23	1.24	1.25
Methionine (%)	0.37	0.36	0.35	0.34	0.33

+A bio-organics nutrient supplement containing Vit. A; 4000000 i.u,Vit. D3; 800000 i.u, Vit. E; 9200mg; Niacin 11000mg; Vit. B2 2000mg; Vit. B6, 1200mg; Vit. B12 6mg; Vit. K3 800mg; Pantothenic acid 3000mg; Biotin 24mg; Folic acid 300mg; Choline Chloride 120000mg; Cobalt 80mg; Copper 1200mg; Iodine 400mg; Iron 8000mg; Manganese 16000mg; Selenium 80mg; Zinc 12000mg; Anti-oxidant 500mg.

Table 2: Percentage composition of graded levels of Sorghum SK-5912 as replacement for maize in broiler finisher diets (5-8 weeks)

Ingredients	Diets 1 (0%)	2 (25%)	3 (50%)	4 (75%)	5 (100%)
Maize	53.04	39.78	26.52	13.26	0.00
Sorghum (SK-5912)	0.00	13.26	26.52	39.78	53.04
Boiled Soya bean	26.16	26.16	26.16	26.16	26.16
Wheat offal	15.00	15.00	15.00	15.00	15.00
Fish meal	2.00	2.00	2.00	2.00	2.00
Bone meal	3.00	3.00	3.00	3.00	3.00
+Premix	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.20	0.20	0.20	0.20	0.20
Total	100	100	100	100	100
Calculated Analysis					
Crude protein (%)	19.50	19.75	20.00	20.25	20.50
ME (Kcal/kg)	3000	2950	2900	2850	2800
Crude fibre (%)	4.24	4.16	4.08	4.00	3.92
Ca (%)	1.32	1.32	1.32	1.33	1.33
P (%)	0.77	0.80	0.83	0.86	0.89
Lysine (%)	1.09	1.11	1.12	1.13	1.15
Methionine (%)	0.49	0.49	0.48	0.47	0.46

+A bio-organics nutrient supplement containing Vit. A; 4000000 i.u,Vit. D3; 800000 i.u, Vit. E; 9200mg; Niacin 11000mg; Vit. B2 2000mg; Vit. B6, 1200mg; Vit. B12 6mg; Vit. K3 800mg; Pantothenic acid 3000mg; Biotin 24mg; Folic acid 300mg; Choline Chloride 120000mg; Cobalt 80mg; Copper 1200mg; Iodine 400mg; Iron 8000mg; Manganese 16000mg; Selenium 80mg; Zinc 12000mg; Anti-oxidant 500mg.

Results

The productive performances of broiler chickens fed dietary levels of sorghum *SK-5912* variety are presented in Table 3. The initial weight of the broiler chicks were similar (81.67 - 83.75g), the body weights at 4 weeks were also similar (733.02 - 855.91g). The total body weight gain (1567.50 - 1841.50g) and final weight ranged (1668.10 - 1925.50g) were all not affected. At the starter phase, daily feed intake (DFI) (50.20 - 54.00g), daily weight gain (DWG) (24.01 - 27.55g) and feed conversion ratio (1.84 - 2.17) all were not differ significant among the treatment groups. The DFI (117.51 - 122.77g) showed no significant difference at the finisher phase. The DWG (40.35 - 49.49g) obtained at the finisher phase were not different also. The FCR (2.47 - 3.01) observed on all the dietary levels of sorghum *SK-5912* were similar. The overall phase DFI (80.44 - 83.38g) showed that there was no significant difference. The DWG (31.73 - 36.83g) did not differ significantly at the overall phase. The FCR (2.27 - 2.64) of all the treatment groups were also similar.

The cost effectiveness analysis of broiler chickens production fed sorghum *SK-5912* variety based diets is shown in Table 4. The total feed intake at the starter phase varied between 1.41 and 1.51kg on diets 3 and 1 respectively. All the values observed on the dietary treatments were lower than the value on the control diet. The feed cost (₦/kg) ranged from ₦134.04 on diet 5 to ₦163.46 on diet 1. The values decreased with increasing levels of sorghum *SK-5912*. The total feed cost (₦) ranged from ₦190.34 diet 5 and ₦246.82 on diet 1. The total weight gain (kg) ranged

from 0.67kg to 0.77kg on diets 5 and 3 respectively during the starter phase. The value on the control diet (0.75kg) is only lower compared to diet 3 (0.77kg). The feed cost in ₦ per kg gain varied between ₦259.58 to ₦329.09 on diets 3 and 1 respectively and were cheaper on other treatment diets than on the control diet ₦329.09.

At the finisher phase, the total feed intake values varied between 2.62kg to 2.70kg for diets 5 and 2 respectively. The values of feed cost (₦/kg), (₦111.64 - ₦144.85) and reduces with increasing level of sorghum *SK-5912* variety. Similarly, the values of total feed cost (₦292.50 -₦382.40) decreased with increasing level of sorghum *SK-5912* variety. The values obtained for total weight gain (0.89 -1.09kg). Feed cost ₦/kg gain (₦314.52 - ₦360.65), except diet 2 (₦360.65), all other values are lower compared to the value on the control diet (₦350.83). The overall total feed intake (4.03 - 4.17kg) and the values observed on diets 2 was higher then followed by the control diet (4.15kg). The feed cost in ₦ per kg gain (₦111.64 - ₦144.85) and decreased with increasing levels of sorghum *SK-5912* variety. The total feed cost values varied between ₦496.27 and ₦639.76 on diets 5 and 1 respectively. The total weight gain had the highest observed value on the control diet (1.84kg) and the least was diet 2 (1.59kg). The highest value observed for feed cost ₦ per kg weight gain was on diet 1 (₦347.70) and the least on diet 4 (₦305.68). The feed cost in ₦ per kg gain of all the treatment groups were lower compared to the value on the control diet and there is a cost saving on all the treatment diets. The percentage cost saving varied between 0.38% on diet 2 and 12.09% on diet 4.

Table 3: Performance of broiler chickens fed graded levels of sorghum SK-5912 as replacement for maize

	Diets					
	1 (0%)	**2 (25%)**	**3 (50%)**	**4 (75%)**	**5 (100%)**	**SEM**
Productive performance						
Initial weight (g)	83.75	81.67	82.85	82.63	82.95	0.76^{NS}
Body weight at 4 wks (g)	855.91	733.02	803.99	758.08	755.05	14.26^{NS}
Final body wgt. at 8wk(g)	1925.30	1668.10	1742.00	1755.40	1679.90	29.32^{NS}
Total weight gain (g)	1841.50	1567.50	1659.20	1672.80	1596.90	29.22^{NS}
Starter phase (1-4 wks)						
Daily feed intake (g)	54.00	52.44	50.20	51.31	50.58	1.21 ^{NS}
Daily weight gain (g)	26.89	24.18	27.55	25.60	24.01	1.03 ^{NS}
Feed Conversion Ratio	2.02	2.17	1.84	2.01	2.12	0.07 ^{NS}
Mortality (Number)	2	3	2	2	1	-
Finisher phase (5-8 wks)						
Daily feed intake (g)	120.07	122.77	120.76	117.51	119.17	1.96^{NS}
Daily weight gain (g)	49.49	41.34	40.35	43.46	42.04	3.27^{NS}
Feed conversion ratio	2.47	3.00	3.01	2.74	2.97	0.20^{NS}
Mortality (Number)	2	0	0	0	2	-
Overall phase (1-8wks)						
Daily feed intake (g)	83.07	83.38	81.24	80.44	80.76	1.28^{NS}
Daily weight gain (g)	36.83	31.73	33.19	33.46	31.94	1.32^{NS}
Feed conversion ratio	2.27	2.64	2.46	2.42	2.56	0.10^{NS}
Mortality (Number)	4	3	2	2	3	-

NS= Not significant, SEM = Standard Error of Means

Table 4: Economic of production of broiler chickens fed graded levels of sorghum *SK-5912* as replacement for maize

Parameters	Diets 1 (0%)	2 (25%)	3 (50%)	4 (75%)	5 (100%)
Starter phase					
Total feed intake (kg)	1.51	1.47	1.41	1.44	1.42
Feed cost (₦/kg)	163.46	142.60	141.76	137.90	134.04
Total feed cost (₦)	246.82	209.62	199.88	198.58	190.34
Total weight gain (kg)	0.75	0.68	0.77	0.72	0.67
Feed cost ₦/kg gain	329.09	308.26	259.58	275.81	284.09
Finisher phase					
Total feed intake (kg)	2.64	2.70	2.66	2.59	2.62
Feed cost (₦/kg)	144.85	121.55	120.25	116.95	111.64
Total feed cost (₦)	382.40	328.19	312.96	302.90	292.50
Total weight gain (kg)	1.09	0.91	0.89	0.96	0.93
Feed cost ₦/kg gain	350.83	360.65	351.64	315.52	314.52
Overall performance					
Total feed intake (kg)	4.15	4.17	4.07	4.03	4.04
Feed cost (₦/kg)	154.16	132.08	132.01	127.43	122.84
Total feed cost (₦)	639.76	550.77	537.28	513.54	496.27
Total weight gain (kg)	1.84	1.59	1.66	1.68	1.60
Feed cost ₦/kg gain	347.70	346.39	323.66	305.68	310.17
Cost saving (₦)	0.00	1.31	24.04	42.02	37.53
% cost saving	0.00	0.38	6.91	12.09	10.79

Discussion

The percentage composition of the experimental diets is shown in Tables 1 and 2, for broiler starter and finisher respectively. The crude protein and metabolizable energy are within the range recommended adequate for raising broiler chickens in the tropics [10, 11, 12].

The productive performance of broiler chickens fed sorghum *SK-5912* based diets at both starter and finisher phases as well as the overall performance was not significantly influenced by the dietary treatments. These observations were in conformity with report of [11], who reported that low tannin yellow sorghum can replace maize without any adverse effect on performance. The result is also in agreement with the findings of [13] who stated that all dietary maize can be replaced with low tannin sorghum without any adverse effect on live weight, feed intake and feed conversion ratio. More so, the result is in agreement with the findings of [14] who reported non-significant difference in the daily feed intake and daily weight gain when he replaced yellow sorghum for maize. This finding therefore revealed that sorghum *SK-5912* hitherto was regarded to have poor taste when prepared as *tuwo* (traditional stiff porridge), unacceptable black colour and poor overnight keeping quality can be effectively used for broiler production with economic benefits.

The feed cost in ₦ per kg which ranged from ₦111.64-₦144.85 decreased with increase in the inclusion level of sorghum *SK-5912* in the diets. The feed cost per kg body weight gain also decreased with increasing

level of sorghum *SK-5912* at both starter and finisher phases. The feed cost in naira per kilogram body weight was least in diet 3 (50% sorghum *SK-5912*) at the starter phase, while diet 4 (75% sorghum *SK-5912*) was the cheapest at the finisher and overall performance. This result agreed with the findings of [1], who reported that replacement of maize by sorghum in broiler diets reduced feed cost.

Conclusion and Applications

This study revealed that performance of broiler chickens were not negatively affected by the dietary levels of sorghum *SK – 5912* variety and the least feed cost was sorghum *SK- 5912* based diets. It can be concluded that

1. Sorghum *SK – 5912* can effectively replace 100% maize in the diets of broiler chickens without compromising performance.
2. The production and utilization of sorghum *SK – 5912* in poultry diets should be encourage as a result of concomitant reduction in feed cost associated with raising these birds.

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