Comparative effects of sorghum SK-5912 (*Sorghum bicolor*, L. Moench) and pearl millet as dietary energy sources on performance and economics of production of broiler chickens

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Abstract

An experiment was conducted with three hundred unsexed day-old broiler chicks (Marshal Strain) to evaluate the effect of sorghum SK-5912 variety as replacement for pearl millet on the growth performance and economics of production of broiler chickens. Five experimental diets were formulated with sorghum SK-5912 replacing pearl millet at 0, 25, 50, 75 and 100% in the diet and tagged as diets 1 (control), 2, 3, 4 and 5 respectively, for both starter phase (23%CP) and finisher phase (20%CP). The chicks were randomly allotted to the dietary treatments with four replications each and 15 birds per replicate in a completely randomized design (CRD). Feed and water were supplied ad libitum throughout the experimental period. The results showed no significant differences in feed intake, daily weight gain and FCR among the treatment means at the starter phase, finisher phase as well as the overall phase. Based on the cost benefit analysis diet 5 (100% sorghum SK-5912) had the cheapest feed cost ₦/kg gain of ₦343.19 while the highest was diet 1 (₦373.85). It can therefore, be concluded that sorghum SK-5912 variety can replace pearl millet up to 100% in the diets of broiler chickens without negatively affecting the growth performance and with concomitant reduction in feed cost.

Keywords: Broiler chickens, Cost, Performance, Pearl millet, SorghumSK-5912, Treatment diets.

Introduction

Poultry production mostly depends on the types, source and quality of feed which accounts for the major share of the cost of raising poultry birds. Feed represents about 70 percent of the total cost of production and 55 percent of the cost of broiler production (Verma, 2014). Poultry industry has been greatly affected by high cost of feed due to competition for the available grains between livestock feed and human consumption, (Olomu, 2011). Maize which forms the major energy source for poultry in the tropics (Oluyemi and Roberts, 2013) is becoming scarce and expensive in the semi-arid zone of Nigeria because of the decline

in its production due to unfavourable climate (Kwari *et al.*, 2012). Pressure on maize and recently sorghum and pearl millet has been on the increase worldwide due to population growth leading to its scarcity (Agbabiaka *et al.*, 2013). The possible alternatives to these cereal grains are the new improved varieties of these grains which are high yielding with low human demand (Etuk *et al.*, 2012), such as sorghum Sk-5912 variety which is readily available in the semi-arid and savannah zones of Northern Nigeria where the effects of climate change such as desertification and drought is currently been experienced. It is alternatively cheaper to maize, other

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varieties of sorghum and pearl millet due to low human demand and provides the birds with comparable energy level (Etuk *et al.*, 2015).

Sorghum SK-5912 variety is yellow in colour, high yielding and drought resistant, tolerant to striga and has relatively low tannin content and low human demand, which makes it good replacement for other costly cereal grains, (ICRISAT, 2003). Sorghum SK-5912 variety was previously used in feeding trials with broiler chickens and turkeys, and the results showed that it can conveniently replace maize as energy sources in broiler chickens and turkey diets (Etuk *et al.*, 2012; Etuk *et al.*, 2015; Lakurbe *et al.*, 2018). Hence, the need to ascertain the effects of its utilization together with other dietary energy feed resources of the semi-arid zones on broiler chickens. Thus, its availability and lower cost due to low human demand makes the variety to be a good dietary energy source for the region and country at large.

This study therefore, evaluated the performance and cost effectiveness of broiler chickens fed graded levels of sorghum SK-5912 variety as a replacement for pearl millet.

Materials and methods

Experimental design

Three hundred experimental birds were randomly allotted to five experimental diets that were replicated four times in a completely randomized design of fifteen birds per replicate. Feed and water were supplied to them *ad libitum* during the experiment which lasted for eight weeks. Five experimental diets for both starter phase (23%CP) and finisher phase (20%CP) were formulated in which sorghum SK-5912 variety replaced pearl millet at 0, 25, 50, 75 and 100% levelled as diets 1 (control), 2, 3, 4, and 5 respectively, using boiled soya bean as plant protein.

Both the starter and the finisher diets were fed for four weeks each. Percentage composition of graded levels of sorghum SK-5912 variety as replacement for pearl millet fed to broiler chickens at the starter phase and finisher phase are presented in Tables, 1 and 2. Body weight, feed consumption and feed conversion ratio were measured as the performance indices and cost per kilogram of feed and feed cost per kilogram weight gain were calculated to show the financial benefit of using sorghum SK-5912 variety as replacement for pearl millet in broiler chickens diets.

Data analysis

Data collected were subjected to analysis of variance techniques as outlined by Steel and Torrie, (1980) using the statistical Software of Minitab, 17.3.1., (Minitab, 2014). Differences between treatment means were separated using Duncan's Multiple Range Test (DMRT), (Duncan, 1955).

Results and discussion

The productive performances of broiler chickens fed sorghum SK-5912 variety as replacement for pearl millet is presented in Table 3. The daily feed intake showed non-significant difference among the treatment means during the starter and finisher phases as well as the overall performance. The feed intake ranged from 56.63-58.11g for the starter and 43.78-45.57g for the finisher phase. The daily weight gain also showed no significant difference between treatment groups at the starter and finisher phases as well as the overall performance. The values obtained in this study are comparable with reports of Kwari *et al.* (2014) when broiler chickens were fed maize, sorghum and millet, and their combinations. However, slightly below values reported by Medugu *et al.* (2010). Feed conversion ratio results also showed non-significant difference at both starter and finisher phases as well as

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

Ingredients	Diets				
	1	2	3	4	5
Pearl Millet	49.75	37.31	24.88	12.44	0.00
Sorghum (SK-5912)	0.00	12.44	24.88	37.31	49.75
Boiled Soya bean	32.45	32.45	32.45	32.45	32.45
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 (%)	23.00	23.00	23.00	23.00	23.00
ME (Kcal/kg)	2800	2800	2850	2900	2900
Crude fibre (%)	3.67	3.92	4.17	4.42	4.67
Ca (%)	1.47	1.46	1.46	1.46	1.46
P (%)	0.95	0.93	0.90	0.87	0.85
Lysine (%)	1.32	1.33	1.34	1.34	1.35
Methionine (%)	0.52	0.53	0.54	0.55	0.56

+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 gr aded levels of Sorghum SK-5912 as replacement for pearl millet in broiler finisher diets (5-8 weeks)

Ingredients	Diets				
	1	2	3	4	5
Pearl Millet	54.34	40.76	27.17	13.59	0.00
Sorghum (SK-5912)	0.00	13.59	27.17	40.76	54.34
Boiled Soya bean	24.76	24.76	24.76	24.76	24.76
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	0.35	0.35	0.35	0.35	0.35
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 (%)	20.00	20.00	20.00	20.00	20.00
ME (Kcal/kg)	2850	2850	2900	2950	2950
Crude fibre (%)	3.74	4.02	4.29	4.56	4.83
Ca (%)	1.33	1.33	1.33	1.32	1.32
P (%)	0.88	0.85	0.83	0.82	0.76
Lysine (%)	1.11	1.12	1.12	1.13	1.14
Methionine (%)	0.46	0.48	0.49	0.50	0.51

+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.

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the overall performance. This result is in conformity with the findings of Medugu *et al.* (2010) that millet and sorghum can completely replace maize in broiler chicken diets without adverse effects on performance. Bulus *et al.* (2014) also, observed and concluded that, complete replacement of maize with pearl millet, finger millets or with yellow guinea corn in broilers diet did not impair feed intake, body weight, feed conversion and nutrient retention. The cost benefit analysis of broiler chickens fed graded levels of sorghum SK-5912 as replacement for pearl millet is presented in Table 4. The feed cost per kg reduced with increase in level of sorghum SK-5912 inclusion at the starter, finisher and overall phases. Similarly, the feed cost per kilogram gain was lowest at

diet 5 and highest on diet 1 (control) with corresponding decrease as the levels of sorghum SK-5912 increases up to diet 5 (100% sorghum SK-5912). This result is in agreement with the findings of Yunusa *et al.* (2015) who reported lower feed cost in naira per kg gain on pearl millet when they fed broilers with different energy sources. This observation could be due to the prevailing market price of sorghum SK-5912 at the time of the study that was relatively cheaper compared to that of pearl millet due to competition for human demands. This is in support of the reports of Kekeocha (1984) and Esonu *et al.* (2003) who stated that a strong economic benefit exists in feeding alternative low cost feed materials to poultry such feed resources reduce cost of feed and maximize the returns from poultry farming.

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

Parameters	Diets					SEM
	1	2	3	4	5	
Production performance						
Initial weight (g)	88.37	84.38	81.08	88.02	80.04	4.32 ^{NS}
Body weight at 4 wks (g)	992.41	952.08	988.89	978.47	962.51	12.83 ^{NS}
Final weight (g)	1949.30	1906.20	1908.30	1903.30	1915.10	41.67 ^{NS}
Total weight gain (g)	1860.80	1821.80	1827.20	1815.30	1836.30	38.77 ^{NS}
Starter phase (1-4 wks)						
Daily weight gain (g)	57.80	56.63	57.82	58.11	57.06	0.71 ^{NS}
Daily weight gain (g)	32.29	30.99	32.42	31.80	31.52	0.74 ^{NS}
Feed Conversion Ratio	1.79	1.83	1.79	1.83	1.81	0.04 ^{NS}
Mortality (Number)	2	2	1	2	1	-
Finisher phase (5-8 wks)						
Daily feed intake (g)	126.76	125.96	123.30	127.37	124.79	1.28 ^{NS}
Daily weight gain (g)	45.57	45.44	43.78	44.04	45.36	1.96 ^{NS}
Feed conversion ratio	2.80	2.79	2.83	2.90	2.76	0.11 ^{NS}
Mortality (Number)	1	2	2	1	2	-
Overall Phase (1-8 wks)						
Daily feed intake (g)	87.35	86.34	85.88	87.79	86.09	0.83 ^{NS}
Daily weight gain (g)	37.98	37.18	37.29	37.05	37.45	0.79 ^{NS}
Feed conversion ratio	2.31	2.32	2.30	2.37	2.30	0.05 ^{NS}
Mortality (Number)						

NS= Not significant, SEM= Standard Error of the Mean

Table 4: Cost benefit of broiler chicken fed graded levels of sorghum SK -5912 as replacement for pearl millet

Parameters	1	2	Diets 3	4	5
Starter phase:					
Total feed intake (kg)	1.62	1.59	1.62	1.63	1.60
Total feed cost (<)	172.16	168.02	161.81	158.67	155.99
Total weight gain (kg)	0.90	0.87	0.91	0.89	0.88
Feed cost </kg gain	309.89	307.07	288.05	290.60	283.61
Finisher phase:					
Total feed intake (kg)	2.66	2.65	2.59	2.67	2.62
Feed cost (</kg)	152.78	149.12	147.53	142.87	141.73
Total feed cost (<)	406.39	395.17	382.10	381.46	371.33
Total weight gain (kg)	0.96	0.95	0.92	0.92	0.95
Feed cost </kg gain	423.32	415.97	415.33	414.63	390.87
Overall performance					
Total feed intake (kg)	4.28	4.24	4.21	4.30	4.22
Feed cost (</kg)	162.47	158.57	154.67	150.77	148.86
Total feed cost (<)	695.37	672.34	651.16	648.31	628.19
Total weight gain (kg)	1.86	1.82	1.83	1.81	1.83
Feed cost </kg gain	373.85	369.42	355.83	358.18	343.19
Cost saving (<)	0.00	4.43	18.02	15.67	30.58
% cost saving	0.00	1.18	4.82	4.19	8.18

Conclusion

It can be concluded that sorghum SK-5912 variety can replace costly pearl millet without negative effect on growth performance with concomitant reduction in cost of raising broiler chickens.

Recommendations

The production of sorghum SK-5912 variety should be encouraged due to its resistance to drought and striga in the semi-arid, and its utilization as dietary energy source for broiler chickens because of low human demand is highly recommended.

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