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COMPARATIVE PERFORMANCE AND CARCASS CHARACTERISTICS OF BROILER CHICKENS FED GRADED LEVELS OF SORGHUM AND PEARL MILLET

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ABSTRACT
A feeding trial was conducted to evaluate the performance and carcass characteristics of broiler chickens fed graded levels of sorghum SK-5912 and pearl millet as dietary energy sources. 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 (23%CP) and finisher (20%CP) phases. Three hundred broiler chickens "Marshal Strains" were randomly allotted to the treatments with four replications of 15 birds per replicate in a completely randomized design (CRD). Feed and water were supplied adlibitum throughout the experimental period (8 weeks). At the end of the experiment eight birds per treatment were randomly selected for carcass and internal organs characteristics. Results showed that performance was not significantly affected by the dietary levels of sorghum SK-5912, pearl millet and their combinations. Similarly, most of the carcass and internal organs parameters measured were not influenced except for the caecal weight (0.42 – 0.74%; $P<0.01$) and small intestine length (151.88 – 194.63 cm; $P<0.01$) that were significantly affected. This study therefore, revealed that sorghum SK-5912, pearl millet and their combinations can be utilized as dietary energy sources without adverse effects on the growth performance and carcass characteristics of broiler chickens.

Keywords: Broiler chickens, Carcass yield, Pearl millet, Performance and Sorghum SK-5912

Introduction

The poultry birds especially broiler chickens play a significant role in the provision of animal proteins required by man to meet his daily protein intake (Maidala and Istifanus, 2012). Poultry industry has been greatly affected by high cost of feed due to competition for 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 because of the decline in its production due to unfavourable climate (Kwari *et al.*, 2011). 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). These trends require serious diversification of energy feedstuffs for poultry, (Etuk *et al.*, 2012). The possible alternatives are new improved varieties of these cereal grains which are high yielding with low human demand (Etuk, *et al.*, ibid), 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 are currently being experienced thereby forcing farmers to shift to the cultivation of crops that are drought resistant with high yield. It is alternatively cheaper to maize, other 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, but it was found to be unsatisfactory by farmers as food *'Tuwo'* because of its poor taste, unacceptable black colour and overnight keeping quality, (ICRISAT, 2003). Sorghum SK-5912 variety was used in feeding trial with turkey, and the results showed that it can conveniently replace maize as energy sources in turkey diets (Etuk, *et al.*, 2012; Etuk, *et al.*, 2015). Hence, the need to ascertain the effects of its utilization together with other dietary energy feed resources on broiler chickens since it has low tannin content, comparable energy levels and low cost due to low human demand and availability. This study therefore, evaluated the performance and carcass characteristics of broiler chickens fed graded

levels of sorghum SK-5912 variety as a replacement for pearl millet.

Materials and Methods

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% coded 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. Daily records of feed intake were taken while body weights were measured on weekly basis. Records of mortality were also taken as they occurred. Routine vaccinations and medications were carried out as and when due. Data obtained on daily feed intake (DFI) and daily weight gain (DWG) were used to determine the feed conversion ratio (FCR). At the end of the experimental period, 2 birds per replicate were randomly selected, fasted for 12 hours before slaughter. The live weights and weights of carcass and weights and lengths of internal organs were measured using sensitive scale and meter rule. 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 percentage compositions of the experimental diets are presented in Tables 1 and 2, for broiler starter and finisher phases respectively. The crude protein and metabolizable energy are within the range adequate for raising broiler chickens in the tropics (Olomu, 2011; Oluyemi and Roberts, 2013). The performance of broiler chickens fed graded levels of sorghum SK-5912 as replacement for pearl millet is presented in Table 3. The daily feed intake values (56.63 – 58.11g: 123.30 – 127.37g; 85.88 – 87.79g) showed non-significant difference among the treatment means at the starter phase, finisher phase and overall phase. The daily weight gain values obtained (30.99 – 32.42g; 43.78 – 45.57g; 37.05 – 37.98g) also showed no significant difference between treatment groups at the starter phase, finisher phase and overall phase. The performances in this study were in conformity with the reports of Kwari *et al.* (2014) who observed that performance were not affected when broiler chickens were fed maize, sorghum, millet, and their combinations as dietary energy sources in the semi-arid zone of Northern Nigeria. 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 and overall performance. This result is in conformity with the findings of Medugu *et al.* (2010) who also noted that considering the weight gain of the birds, 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 carcass and internal organs characteristics of broiler chickens fed dietary levels of sorghum SK-5912 as replacement for pearl millet are also presented in Table 4. The live weights were not significantly influenced, values varied between 2.03 and 2.43 kg. The plucked weight varied between 1.71 and 2.00kg, and eviscerated weight from 1.42 to 1.71 kg, but all were not affected by the dietary treatments. The dressing percentage values ranged from 63.09 to 64.87% on diets 3 (50% sorghum SK-5912) and 5 (100% sorghum SK-5912) respectively. Although, similar values obtained were slightly above the values (58.24-63.85%) obtained and reported by Yunusa *et al.* (2014), and below values (67.187-81.247%) reported by Kwari *et al.* (2014). It is comparable to that of Salami *et al.* (2004) who reported 65-70% as the ideal dressing percentage for well finished broiler chickens. The result is being supported by Raju *et al.* (2003) in an isocaloric and isonitrogenous diet containing pearl millet found and reported that these parameters were statistically comparable to maize fed group. Likewise, Rama Rao *et al.* (2003) in their study on broiler fed with pearl millet at graded levels replacing maize did not find any statistical difference on the parameters measured. The lungs values of 0.44 and 0.54%, the heart values of 0.31 and 0.36%, liver values of 1.38 and 1.78% obtained were all not significantly different across the dietary levels of sorghum SK-5912 replacing pearl millet. The values of kidney weight varied between 0.03% and 0.04%, abdominal fat varied between 0.98% and 1.57%, gizzard weight 1.56% - 1.92%. However, all did not differ across the dietary treatment. The caecal weight differed significantly ($P<0.01$) and values obtained varied from 0.42% to 0.74% (diet 3), pancreas weights of 0.15 - 0.19%, small intestine weight values of 2.49% - 3.36% were obtained. However, small intestine lengths differed significantly ($P<0.01$) across the treatment groups, the highest obtained was 194.63cm for diet 3 and lowest (151.88cm) was for diet 4. The values obtained for large intestine weights are between 0.15 and 0.29%, and the large intestine length values ranged from 11.63 to 14.13cm. The spleen weight values of 0.08% - 0.12%, all were also

not influenced by the dietary levels of sorghum SK-5912 variety replacing pearl millet, and values obtained are in conformity with the results of Yunusa *et al.* (2014) who fed broiler chickens different dietary energy sources.

Conclusion

The study revealed that performance and carcass characteristics of broiler chickens were not adversely affected by the utilization of graded levels of sorghum SK-5912, pearl millet and their various combinations. Thus, it can be concluded that sorghum SK-5912 variety can effectively be utilised solely or in combination at various levels of pearl millet as dietary energy sources for broiler chickens.

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

	Diets				
Ingredients	**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 graded levels of Sorghum SK-5912 as replacement for pearl millet in broiler finisher diets (5-8 weeks)

	Diets				
Ingredients	**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.

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

	Diets					
Parameters	**1**	**2**	**3**	**4**	**5**	**SEM**
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: Carcass and visceral organs characteristics of broiler chickens fed graded levels of sorghum SK-5912 as replacement for Pearl millet

	Diets					
Parameters	**1**	**2**	**3**	**4**	**5**	**SEM**
Live weight (kg)	2.43	2.27	2.26	2.03	2.23	0.10^{NS}
Plucked weight (kg)	2.00	1.85	1.89	1.71	1.87	0.08^{NS}
Eviscerated weight (kg)	1.71	1.58	1.56	1.42	1.55	0.07^{NS}
Carcass weight (kg)	1.58	1.45	1.42	1.31	1.44	0.06^{NS}
Dressing Percentage	64.86	64.46	63.09	64.83	64.87	1.27^{NS}
Lungs weight (%)	0.44	0.54	0.48	0.48	0.45	0.03^{NS}
Heart weight (%)	0.32	0.36	0.35	0.31	0.32	0.02^{NS}
Liver weight (%)	1.45	1.78	1.71	1.70	1.38	0.27^{NS}
Kidney weight (%)	0.03	0.04	0.03	0.03	0.03	0.006^{NS}
Abd.fat weight (%)	1.41	1.34	1.57	0.98	1.44	0.22^{NS}
Gizzard weight (%)	1.56	1.57	1.64	1.92	1.57	0.10^{NS}
Caecal weight (%)	0.42^{b}	0.67^{ab}	0.74^{a}	0.62^{ab}	0.48^{b}	0.25**
Caecal length (cm)	18.38	20.91	19.43	20.81	19.13	1.78^{NS}
Pancreas weight (%)	0.15	0.19	0.19	0.18	0.15	0.20^{NS}
Small intestine wt (%)	2.49	2.68	2.86	3.36	2.69	0.22^{NS}
S/ intestine length (cm)	181.25^{ab}	181.75^{ab}	194.63^{a}	151.88^{b}	159.13^{b}	32.37**
Large intestine wt (%)	0.23	0.22	0.15	0.29	0.25	0.04^{NS}
L/ intestine length(cm)	11.63	12.35	11.89	13.13	14.13	1.62^{NS}
Spleen weight (%)	0.08	0.12	0.10	0.10	0.08	0.01^{NS}

^{abc} Implies bearing different superscripts within the same row differ ** = (P< 0.01), NS= Not significant; SEM= Standard error of means