

Carcass characteristics and blood components of broiler chickens fed sorghum sk-5912 (*sorghum bicolor* l. moench) variety in mixture with different plant protein sources

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Abstract

The effect of feeding sorghum SK-5912 variety with different plant protein sources to broiler chickens on the carcass characteristics and blood parameters were investigated. Five diets were formulated in which maize with boiled soya bean (MBSB) was used as the control and sorghum SK-5912 variety was combined with boiled soya bean (SBSB), soya bean meal (SSBM), industrial ground nuts cake (SIGNC) and local ground nuts cake (LGNC) tagged as diets 1 (control), 2, 3, 4 and 5 respectively. Three hundred broilers chicks 'marshal strain' were randomly allotted to the dietary treatments with four replications in a completely randomized design. Feed and water were supplied ad libitum and the feeding trial lasted for eight weeks. At the end of feeding trial eight birds per treatment were randomly selected for carcass analysis, blood samples were collected for haematological and serum biochemical analysis. Results showed that all the carcass and gut parameters measured did not differ ($P>0.05$) significantly. Packed cell volume, Red blood cells, White blood cells and platelets were also not influenced ($P>0.05$) by the dietary treatments. However, results obtained were inferior in the control diet. Serum biochemical indices were also not affected except the high density lipoproteins (HDL) that was ($P<0.05$) affected across the dietary treatments. Despite control diet had the best HDL (mmo/L), but all values obtained were within the normal range. This study therefore, revealed that sorghum SK-5912 variety can completely replace maize and favourably combine with different plant protein sources with no detrimental effect on the carcass yield and blood constituents of broiler chickens.

Key words: Broiler, Carcass, Haematology, Plant proteins, Serum, Sorghum SK-5912

Description of Problem

The energy source component of poultry diets represents the largest single dietary ingredient. Maize which is the main source of energy in poultry diets over the year has become very expensive due to human - animal competition and other industrial use coupled with low production in the drier areas of the tropics, [1]. The situation therefore requires research interest in sourcing for alternative energy feedstuffs in poultry feeds [2]. One of such alternatives is sorghum SK-5912 variety

largely produced in the northern part of Nigeria with low human demand. The sorghum SK-5912 is yellow in colour, high yielding, drought resistant, tolerant to striga and has relatively low tannin content, but it was found to be unsatisfactory by farmers as food. The variety had poor taste when prepared as 'tuwo', the traditional stiff porridge, with unacceptable black colour and poor overnight keeping quality, [3]. [4] reported that sorghum SK-5912 (SAMSORG-17) can play an important role in poultry diets in a trial where

two new improved varieties of sorghum namely SAMSORG-17 and ICSV 400 as sources of dietary energy in turkey poult feed. The haematology and serum parameters did not vary much from the normal, and therefore recommended that the use of the sorghum varieties would improve the feed supply system of the birds at affordable cost in poultry feeds. The main vegetable protein sources in animal feeds include oil seeds such as the soya bean meal and ground nuts cake, [5]. It is therefore important to evaluate the dietary value of the sorghum SK-5912 / plant protein source combination in the diets of broiler chickens for performance and cost benefits. This study therefore was designed to assess the carcass characteristics and blood components of broiler chickens fed sorghum SK-5912 variety combined with different vegetable protein sources.

Materials and Methods

A total of three hundred (300) birds were allotted to five treatment diets that were replicated four times in a completely randomized design feeding trial of fifteen birds per replicate. Feed and water were supplied *ad libitum* during the experimental period which lasted for eight weeks. Five experimental diets for both starter and finisher phases were formulated. Maize with boiled soya bean (MBSB) was used as the control while sorghum SK-5912 variety combined separately with boiled soya bean (SBSB), soya bean meal (SSBM), industrial ground nuts cake (SIGNC) and local groundnuts cake (SLGNC) constituted the treatments. They were tagged as diets 1, 2, 3, 4 and 5 respectively (Tables 1 and 2). Routine vaccinations and medications were carried out accordingly. At the end of the experimental period, eight birds per treatment were randomly selected, fasted for 12 hours before slaughtering so as to allow for the

emptying of the crop and excretion of the undigested feed residues. Out of the 8 birds slaughtered blood samples were collected for haematological and serum biochemical analysis. The live weights, weights of carcass, weights and lengths of some internal organs were measured using sensitive scale (CAMRY-EHA251) and meter rule (universe). Data were collected on carcass measurements plucked weight, eviscerated weights, dressing percentages were calculated as percent of live weight after bleeding and feathering, and internal organs weights expressed as percent of live weight. The samples bird were bled using a sterilized knife through the jugular vein. Blood samples were collected into sample tubes containing drops of ethylene diamine tetra-acetic acid (EDTA) as anticoagulant for haematology parameters analysis namely, packed cell volume (PCV), red blood cells (RBC) count, white blood cells (WBC) count, and haemoglobin concentration (Hbc), while the mean cell volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC) and platelets were calculated. They were measured according to the methods described by Bush [6]. Serum was obtained after the blood in the anticoagulant free tubes was allowed to stand for two hours at room temperature and centrifuged at 2,000 revolutions per minute for 10 minutes using a Biotech 521 bucket centrifuge. Total proteins (TP), albumin, globulin, creatinine, total cholesterol, high density lipoproteins (HDLP), low density lipoproteins (LDLP), triglycerides, alanine amino transferase (ALT), and aspartate amino transferase (AST) were determined. Data collected were subjected to the one-way analysis of variance using Minitab software statistical package [7]. Differences between treatment means were compared using Duncan's Multiple Range Test, DMRT, [8].

Table 1: Percentage composition of dietary levels of sorghum SK-5912 with different plant protein sources fed to broiler starters (1- 4 weeks)

Ingredients	Diets				
	1 (MBSB)	2 (SBSB)	3 (SSBM)	4 (SIGNC)	5 (SLGNC)
Maize	49.68	0.00	0.00	0.00	0.00
Sorghum (SK-5912)	0.00	49.68	49.68	49.68	49.68
Boiled Soya bean	32.52	32.52	32.52	32.52	32.53
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)	2950.00	2900.00	2850.00	2800.00	2800.00
Crude fibre (%)	4.10	4.02	3.95	3.88	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. MBSB = Maize + Boiled Soya Bean, SBSB = Sorghum SK-5912 + Boiled Soya Bean, SSBM = Sorghum SK-5912 + Soya Bean Meal, SIGNC = Sorghum SK-5912 + Industrial Groundnuts Cake, SLGNC = Sorghum SK-5912 + Local Groundnuts Cake.

Table 2: Percentage composition of dietary levels of sorghum SK-5912 with different plant protein sources fed to broiler finishers (5 – 8 weeks)

Ingredients	Diets				
	1 (MBSB)	2 (SBSB)	3 (SSBM)	4 (SIGNC)	5 (SLGNC)
Maize	53.91	0.00	0.00	0.00	0.00
Sorghum (SK-5912)	0.00	53.91	53.91	53.91	53.91
Boiled Soya bean	25.29	25.29	25.29	25.29	25.29
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 (%)	20.00	20.00	20.00	20.00	20.00
ME (Kcal/kg)	2950.00	2950.00	2900.00	2850.00	2850.00
Crude fibre (%)	4.08	4.01	3.93	3.85	3.77
Ca (%)	1.71	1.71	1.71	1.72	1.72
P (%)	0.73	0.76	0.79	0.82	0.85
Lysine (%)	1.10	1.12	1.13	1.14	1.16
Methionine (%)	0.43	0.42	0.40	0.39	0.38

+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. MBSB = Maize + Boiled Soya Bean, SBSB = Sorghum SK-5912 + Boiled Soya Bean, SSBM = Sorghum SK-5912 + Soya Bean Meal, SIGNC = Sorghum SK-5912 + Industrial Groundnuts Cake, SLGNC = Sorghum SK-5912 + Local Groundnuts Cake.

Results and Discussion

The crude protein and metabolizable energy values of the experimental diets are adequate for birds raised under tropical climates [9,10,11] as presented in Tables 1 and 2. The carcass internal organ characteristics of broiler chickens fed sorghum SK-5912 with different plant protein sources is presented in Table 3. Results showed that the live weights, plucked weights, eviscerated weights and carcass weights were all similar across the dietary treatments. The dressing percentage varied from 67.77 to 69.45% in the birds fed diets 4

(sorghum SK-5912 + Industrial GNC) and control respectively. The results obtained for dressing percentage in this study were similar. These results are in agreement with that of [12] who reported that there was no significant difference among the treatments in whole carcass or weights of carcass parts of broiler chickens fed on sorghum based diets at 42 days of age. All the gut parameters measured showed non-significant difference ($P > 0.05$) among the treatment groups. This finding was similar to the observations of [13] who reported that groundnuts cake had no negative

effect on carcass characteristics of broiler chickens, but in contrast to [14] who reported variation in carcass characteristics of broiler chickens fed different energy sources, probably due to varietal differences.

The results of the haematological and serum biochemical indices are presented in Tables 4 and 5. The results obtained showed that all the haematological parameters measured were not significantly difference ($P>0.05$) across the dietary treatments. The packed cell volume (PCV) values ranged from 33.80 to 38.40% and the haemoglobin (Hb) concentration ranged from 10.18 to 11.94g/dl which were similar to the values obtained on the control. The serum biochemical indices were also similar except the high density lipoprotein that was significantly ($P<0.05$) influenced by the treatment groups. The different protein sources therefore, did not

affect the haematological and corpuscular indices, the values obtained are within the normal range indicating that birds were nourished and the diets were ideal and adequate for broiler chickens [15, 16,17]. Mean serum total protein values ranged from 40.50 to 52.75g/l, which agrees with those reported by [17] for birds fed diets containing maize, sorghum and millet, and their combinations. Albumin and globulin values ranged between 12.25-19.50g/l and 24.25-40.50g/l respectively while the serum enzymes AST and ALT recorded similar values separately and were not beyond the threshold which may be an indication of a better quality protein in the test diet [18, 19]. However, serum enzymes beyond threshold could mean the implication of liver damage and bone marrow demineralization [4, 20].

Table 3: Carcass characteristics of broiler chickens fed sorghum SK-5912 with different plant protein sources

Parameters	Diets					SEM
	1	2	3	4	5	
Live weight (kg)	1.61	1.59	1.51	1.61	1.52	0.05 ^{NS}
Plucked weight (kg)	1.46	1.42	1.36	1.47	1.38	0.04 ^{NS}
Eviscerated weight (kg)	1.26	1.26	1.19	1.24	1.22	0.04 ^{NS}
Carcass weight (kg)	1.13	1.10	1.04	1.13	1.04	0.04 ^{NS}
Dressing percentage (%)	69.45	69.35	69.30	67.77	68.39	2.04 ^{NS}
Lungs weight (%)	0.53	0.46	0.63	0.54	0.62	0.07 ^{NS}
Heart weight (%)	0.52	0.50	0.57	0.53	0.56	0.04 ^{NS}
Liver weight (%)	1.52	1.58	1.62	1.54	1.59	0.10 ^{NS}
Kidney weight (%)	0.25	0.26	0.24	0.24	0.28	0.04 ^{NS}
Abdominal fat weight (%)	1.87	1.71	1.62	1.54	1.44	0.15 ^{NS}
Gizzard weight (%)	3.05	3.06	3.18	2.91	2.64	0.29 ^{NS}
Small intestine weight (%)	3.12	2.85	2.53	3.08	2.98	0.29 ^{NS}
Small intestine length (cm)	158.82	148.75	158.13	156.75	156.75	4.51 ^{NS}
Large intestine weight (%)	0.36	0.45	0.47	0.41	0.23	0.07 ^{NS}
Large intestine length (cm)	8.73	8.88	8.62	9.39	8.52	0.56 ^{NS}
Caecal weight (%)	0.52	0.47	0.58	0.52	0.54	0.04 ^{NS}
Caecal length (cm)	17.13	16.38	16.88	16.50	16.75	0.60 ^{NS}
Pancreas weight (%)	0.28	0.23	0.27	0.27	0.31	0.04 ^{NS}
Spleen weight (%)	0.17	0.16	0.19	0.17	0.17	0.02 ^{NS}

NS=Not Significant, SEM=Standard Error of Mean.

Table 4: Haematological values of broiler chickens fed sorghum SK-5912 based diets

Parameters	Diets					SEM
	1	2	3	4	5	
PCV (%)	33.80	36.65	38.40	37.28	33.90	1.74 ^{NS}
WBC ($\times 10^3/\mu\text{l}$)	245.13	253.15	261.60	260.02	248.22	4.83 ^{NS}
RBC ($\times 10^6/\mu\text{l}$)	2.26	2.39	2.53	2.39	2.19	0.11 ^{NS}
Hb (g/dl)	10.33	11.05	11.94	10.90	10.18	0.35 ^{NS}
MCV (fl)	125.18	153.70	150.85	156.32	152.47	7.93 ^{NS}
MCH (pg)	45.83	46.30	46.95	45.80	46.83	0.82 ^{NS}
MCHC (g/dl)	30.55	30.15	31.18	29.35	30.98	0.79 ^{NS}
PLT ($\times 10^3/\mu\text{l}$)	75.75	186.00	191.13	129.50	90.25	24.35 ^{NS}

NS= Not significant, SEM= Standard error of mean, PCV= Packed Cell Volume, RBC= Red Blood Cell, WBC= White Blood Cell, Hb= Haemoglobin Concentration, MCV= mean corpuscular volume, MCH= mean corpuscular haemoglobin, MCHC= mean corpuscular haemoglobin concentration, PLT= Platelet.

Table 5: Serum biochemical values of broiler chickens fed sorghumSK-5912 based diets

Parameters	Diets					SEM
	1	2	3	4	5	
Total Protein (g/l)	40.50	47.00	47.75	52.75	45.50	2.20 ^{NS}
Albumin (g/l)	16.25	14.50	19.50	12.25	12.50	1.56 ^{NS}
Globulin (g/l)	24.25	32.50	28.25	40.50	33.00	2.02 ^{NS}
Creatinine ($\mu\text{mol/l}$)	4.83	2.30	2.75	8.68	16.70	4.02 ^{NS}
Cholesterol (mmol/l)	5.00	5.20	5.78	4.83	3.35	0.42 ^{NS}
HDL (mmol/l)	2.83 ^a	2.10 ^b	1.48 ^c	1.28 ^c	1.33 ^c	0.43 [*]
LDL (mmol/l)	1.33	1.75	1.83	2.00	1.90	0.27 ^{NS}
Triglyceride (mmol/l)	1.25	1.50	0.98	0.75	0.95	0.30 ^{NS}
AST (iu)	219.25	149.00	127.00	132.25	70.50	18.62 ^{NS}
ALT (iu)	29.50	67.50	62.25	51.25	13.00	6.89 ^{NS}

^{abc} Means bearing different superscripts within the same row differ * = (P<0.05), NS= Not significant, SEM= Standard error of mean, AST= Aspartate amino transferase, ALT= Alanine amino transferase

Conclusion and Applications

This study showed that the carcass characteristics, haematological and serum biochemical indices were not adversely affected by the inclusion of sorghum SK-5912 variety in mixture with different vegetable

protein sources. It can therefore be concluded that

1. Sorghum SK-5912 can be used as sole dietary energy source when either of boiled soya bean, soya bean meal, industrial groundnuts cake or local groundnuts cake served as the main

source of vegetable protein for broiler chickens without compromising the carcass characteristics and health of the broiler birds.

2. The production of sorghum SK-5912 variety should be encouraged and its utilization in poultry diets will improve the feed supply system at minimal cost.

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