GROWTH PERFORMANCE AND CARCASS MEASUREMENTS OF BROILER CHICKENS FED DIFFERENT LEVELS OF RAW SORREL *(Hibiscus sabdariffa)* SEED MEAL

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ABSTRACT

The growth performance and carcass measurements of broiler chickens fed different levels of raw sorrel (Hibiscus sabdariffa) seed meal replacing soyabean meal as the major protein source were investigated in a 63-day feeding trial. One hundred and fifty day-old Anak-2000 broiler chicks were individually weighed and allotted to five experimental diets in which raw sorrel seed meal (RSSM) replaced soyabean meal at 0 (control), 25, 50, 75 and 100% levels in diets 1, 2, 3, 4 and 5 respectively. The diets and clean drinking water were offered ad libitum throughout the period of the experiment. Results of the study showed among others that final live weight and daily feed intake were depressed above 50% level of soyabean meal replacement with raw sorrel seed meal in the diets. Raw sorrel seed meal can therefore replace soyabean meal upto 50% without adverse effect on broiler performance.

Keywords: *soyabean meal, sorrel seed meal, broilers, growth, carcass measurements.*

INTRODUCTION

Sorrel *(Hibiscus sabdariffa)* is a popular plant belonging to the family Malvoceae that has been cultivated in Asia for over 300 years and is now cultivated in many countries of the world (Tindal, 1986). In Nigeria, the cultivation is steadily expanding due mainly to increasing demand for both domestic and industrial uses. At the moment, the crop is cultivated mainly for its calyxes but its leaves and seeds are also used for soup and as a pot herb (Adigun, 2003).

Several workers have reported on the chemical composition of the seeds. Sorrel seed is reported to contain between 24.00-35.91% crude protein (Duke, 1983; Dashak and Nwanegbo , 2002; Isidahomen, Kwari, Adejumo and Igwebuike, 2006). Dashak and Nwanegbo (2002) observed that the amino acid profile of sorrel seed protein is similar to that of sesame seed (beniseed). The fat content of the seed varies from 10.14-30.00% (Duke, 1983; Dashak and Nwanegbo, 2002; Isidahomen, Kwari, Adejumo and Igwebuike, 2006) while the ash content has been reported to be 7.00% (Isidahomen, Kwari, Adejumo and Igwebuike, 2006) and 10.09% (Dashak and Nwanegbo , 2002). Sorrel seed contains between 7.12% (Dashak and Nwanegbo , 2002) and 15% (Isidahormen, Kwari, Adejumo, and Igwebuike, 2006) crude fibre.

The seeds however, contain some antinutritional factors (Purseglove, 1969) which are known to have detrimental effects on feed utilization, growth rate and health of growing animals (Jansman, 1993). Duke (1983) identified tannins as being the major antinutritional factor in sorrel seed. At the moment, there is little or no documented information on the utilization of sorrel seed as feed ingredient for poultry. This study reports the growth performance and carcass characteristics of broiler chickens fed different levels of raw sorrel seed meal.

MATERIALS AND METHODS

One hundred and fifty day-old Anak 2000 broiler chicks (mixed-sex) purchased from ECWA Rural Development, Jos were used for the study which lasted for 9 weeks (from 22nd February to 29th April, 2008). The chicks were individually weighed and assigned to five dietary treatments in groups of 30 chicks per treatment. Each treatment was replicated three times with 10 birds per replicate in a completely randomized design (CRD). Birds of each replicate were housed in floor pens measuring 1.44 m^2 with the floor covered with wood shavings as litter material.

Five experimental diets were formulated for the starter and finisher phases

using locally procured feed ingredients (Tables 1 and 2). Raw sorrel seed meal was incorporated into the diets at 0, 25, 50, 75 and 100% levels of replacement for soyabean meal as the major protein source and designated as diets 1 (control), 2, 3, 4 and 5 respectively. The experimental diets (broiler starter and finisher mashes) were provided ad libitum throughout the duration of the experiment (9 weeks).

Data were collected on the performance indices (feed intake, weight gain, final weight and feed conversion ratio), carcass parameters (dressing percentage and the yields of the drumsticks, thighs, breast muscle and wings and abdominal fat deposition). A weighed quantity of feed was supplied daily and the leftover was weighed each morning and subtracted from the quantity supplied to obtain the daily feed intake. The birds were individually weighed at the commencement of the study and at weekly intervals to determine the weekly and subsequently the daily weight gain. Feed Conversion Ratio (FCR) was calculated as the ratio of feed intake to weight gain as follows:

$$\text{FCR} = \frac{\text{feed intake}}{\text{weight gain}}$$

At the end of the experiment, six birds were randomly selected from each treatment group (i.e. 2 per replicate) and used for the carcass measurements. The birds were fasted overnight before slaughtered the next morning. The slaughtered birds were scalded in hot water (50^{o}C) for 1 minute, and then plucked and eviscerated manually. The eviscerated chicken was dressed by removing the neck and the shanks and the dressed chicken (carcass) was weighed and expressed as a percentage of the weight of the living bird before slaughter. The carcass cut up parts (drumsticks, thighs, breast muscle and wings) and the abdominal fat were equally weighed and expressed as percentages of their respective live weight.

The experimental diets (Tables 1 & 2) were analyzed for proximate composition according to AOAC (1990). Growth and carcass data were subjected to analysis of variance (Steel and Torrie, 1980) using a completely randomized design and where significant differences were observed, means were separated using the Duncan's Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

The proximate composition of the experimental diets is presented on Tables 1 and 2. The crude protein (CP) content of the diets decreased steadily as the level of raw sorrel seed meal (RSSM) increased. Dashak and Nwanegbo (2002) reported 35.91% crude protein in sorrel seed while soyabean meal contains

about 44% crude protein (Olomu, 1995). These differences may be the reason for the trend of dietary crude protein in this study. Data on growth performance are presented on Table 3. Final body weight, daily feed intake were depressed ($P<0.05$) above 50% level of replacement of soyabean meal (SBM) with raw sorrel seed meal (RSSM). Daily weight gain was significantly ($P<0.05$) reduced on the 50% replacement diet compared to the control, but did not differ ($P>0.05$) among the SBM-based diets and between the control and the 25% diets.

Despite the depressive effects, the final body weights in all the groups were comparable to values (1820-2120g) obtained by Udedibie, Angaegvo, Onyechukwu and Egbuokporo (2004) who fed some non-conventional feeds to broilers. Feed conversion ratio (FCR) was poorer ($P<0.05$) in the 50% group compared to the control, but was not different ($P>0.05$) among the RSSM-based diets as well as among the control and the 25, 75 and 100% levels of replacement. The reason for the poorer FCR in the 50% group was not clear, but the similarities among the control and the other RSSM-based diets are an indication that FCR is not affected by the level of RSSM inclusion in broiler chickens diets.

Carcass data are presented on Table 4. Dressing percentage and the yields of the wings, thighs and drumsticks were not affected ($P>0.05$) by the level of RSSM inclusion in the diet. Breast muscle yield was significantly ($P<0.05$) improved from the 50% replacement group. There were no significant ($P>0.05$) differences between the control and the 25% replacement and among the RSSM-based diets. The abdominal fat yield was markedly ($P<0.05$) reduced on the RSSM-diets compared to the control. Yalcin, Ozkan, Acikgoz and Ozkan (1999) observed that breast yield was increased and carcass fat reduced with increments in dietary methionine in broiler chickens. Sorrel seed contains about 1.41% methionine (Dashak and Nwanegbo, 2002) against about 0.51% in soyabean (Smith, 2001). This difference in the methionine content between the two ingredients which might have resulted to an increase in dietary methionine as the level of replacement increased may be a possible explanation for the trend of breast meat and abdominal fat deposition in the present study.

The carcass yields were all within the range (65 - 77%) reported by Jourdain (1980) and Oluyemi and Robert (1988) for 9 week-old broilers. The yields of the drumsticks, thighs and breast muscle were also comparable to values reported by Oluyemi and Robert (1988); Mack, Bercovici, De Groote, Leclercq, Lippens, Pack, Schuttle and Van Cauwenberghe (1999). The yields of the wings in all the groups were however; lower than the 8.21% reported by Oluyemi and Robert (1988). The reason for this was not understood. Daily weight gain was

depressed above 25% compared to the control, but did not differ among the RSSM-based diets. Dressing percentage and the yields of the wings, thighs and drumsticks were not affected by the level of RSSM inclusion in the diet. Breast muscle yield was significantly improved from the 50% replacement group. There were no significant differences between the control and the 25% replacement and among the RSSM-based diets. The abdominal fat yield was markedly reduced on the RSSM-diets compared to the control.

CONCLUDING REMARK

Based on the above analysis, it is therefore concluded that Raw Sorrel Seed Meal can therefore replace soyabean meal upto 50% without adverse effects on the growth and carcass measurements of broiler chickens.

Table 1: Ingredients and analyzed chemical composition of the broiler starter diets

Ingredients (%)	**Level of replacement of soyabean meal by sorrel seed meal**				
	0%	25%	50%	75%	100%
Maize	54.00	54.00	54.00	54.00	54.00
Soyabean meal	24.00	18.00	12.00	6.00	0.00
RSSM	0.00	6.00	12.00	18.00	24.00
Wheat offal	9.00	9.00	9.00	9.00	9.00
Fish meal	8.00	8.00	8.00	8.00	8.00
Blood meal	2.00	2.00	2.00	2.00	2.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Premix *	0.50	0.50	0.50	0.50	0.50
Salt (NaCl)	0.20	0.20	0.20	0.20	0.20
Methionine	0.30	0.30	0.30	0.30	0.30
Total	100.00	100.00	100.00	100.00	100.00
Analysed Chemical Composition (%)					
Dry matter (DM)	93.20	92.50	92.65	92.25	92.30
Crude protein (CP)	20.39	20.14	19.78	19.60	19.30
Crude fibre (CF)	12.00	12.50	12.60	12.90	14.00
Crude fat (Ether Extract (EE)	16.25	11.00	9.50	8.75	8.60
Nitrogen Free Extract (NFE)	42.33	47.06	49.27	49.50	49.12
Total ash	2.25	1.80	1.50	1.50	1.28
ME (Kcal/Kg)*	3573.40	3306.81	3250.45	3191.20	3154.46

ME (Kcal/Kg)* = 37 x % CP + 81 x % EE + 35.5 x % NFE (Pauzenga, 1985)

**Premix (OPTMIX PREMIX - ANIMAL CARE) Composition/Kg: Vit. A 5000Iμ; Vit. D3, 888, 000IU; Vit. E, 12,000mg; Vit. K3; 1500mg; Vit. B1, 1000mg; Vit. B2, 2000mg; Vit. B6, 1600mg; Niacin, 12,000mg; Pantothenic acid, 2000mg; Biotin, 1000mg; Vit. B12, 3000mg; folic acid, 15000mg; Choline Chloride, 60,000mg; Manganese, 10,000mg; Iron, 15000mg;Zinc, 800mg; Copper, 400mg; Iodine, 80mg; cobalt, 40mg; Selenium, 8000mg.*

RSSM = Raw Sorrel Seed Meal.

Table 2: Ingredients and Analyzed Chemical composition of broiler the finisher diets

Ingredients (%)	**Level of replacement of soyabean meal by sorrel seed meal**				
	0%	25%	50%	75%	100%
Maize	56.00	56.00	56.00	56.00	56.00
Soyabean meal	22.00	16.50	11.00	5.50	0.00
RSSM	0.00	5.50	11.00	16.50	22.00
Wheat offals	10.00	10.00	10.00	10.00	10.00
Fish meal	7.00	7.00	7.00	7.00	7.00
Blood meal	2.00	2.00	2.00	2.00	2.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Premix*	0.50	0.50	0.50	0.50	0.50
Salt (NaCl)	0.20	0.20	0.20	0.20	0.20
Methionine	0.30	0.30	0.30	0.30	0.30
Total	100.00	100.00	100.00	100.00	100.00
Analysed Chemical Composition (%)					
Dry matter (DM)	90.40	90.30	90.20	91.50	88.80
Crude protein(CP)	18.82	18.64	17.90	17.86	16.80
Crude fibre (CF)	16.00	16.30	16.74	16.76	17.20
Ether extract (EE)	19.50	19.60	18.90	18.70	17.50
Nitrogen free extract (NFE)	32.63	31.76	33.46	32.81	36.10
Ash	3.45	4.00	4.20	3.67	3.90
ME (Kcal/Kg)*	3434.21	3402.63	3381.03	3340.28	3320.65

*ME: Metabolizable Energy calculated according to the formula of Pauzenga (1985) as ME (Kcal/kg)=37 X % CP + 81 X % EE + 35.5 X % NFE.

**Premix finisher (OPTMIX PREMIX - ANIMAL CARE) Composition/Kg: Vit. A 5000Iμ; Vit. D3, 888, 000IU; Vit. E, 12,000mg; Vit. K3; 1500mg; Vit. B1, 1000mg; Vit. B2, 2000mg; Vit. B6, 1600mg; Niacin, 12,000mg; Pantothenic acid, 2000mg; Biotin, 1000mg; Vit. B12, 3000mg; folic acid, 15000mg; Choline Chloride, 60,000mg; Manganese, 10,000mg; Iron, 15000mg;Zinc, 800mg; Copper, 400mg; Iodine, 80mg; cobalt, 40mg; Selenium, 8000mg. RSSM = Raw Sorrel Seed Meal.*

Table 3: Growth performance of broiler chickens fed graded levels of raw sorrel *(Hibiscus sabdariffa)* seed meal.

Parameters	**Level of replacement of soyabean meal by raw sorrel seed meal (Treatments)**					
	0%	25%	50%	75%	100%	SEM
Mean initial live weight (g)	460.51	440.89	450.16	446.22	450.13	4.11^{NS}
Mean final live weight (g)	2250.30^{a}	2140.10^{a}	2138.00^{b}	1980.86^{c}	1800.76^{d}	33.35*
Overall weight gain (g)	1789.79^{a}	1699.21^{b}	1687.84^{b}	1534.64^{c}	1350.63^{d}	28.14*
Mean daily feed intake (g)	119.88^{a}	116.64^{ab}	114.79^{b}	100.90^{c}	99.76^{c}	1.61*
Mean daily weight gain (g)	42.59^{a}	40.08^{ab}	35.12^{b}	35.12^{b}	32.32^{bc}	1.79
Feed Conversion Ratio (g feed/g gain)	2.81^{b}	2.91^{ab}	3.2^{1a}	2.87^{ab}	3.09^{ab}	0.13

a b c d = Means within the same row with different superscripts are significantly different (P< 0.05).

*SEM = Standard error of means (P> 0.05). NS = Not significant (P> 0.05). * = Significant (P< 0.05)*

Table 4: Carcass measurements of broiler chickens fed graded levels of raw sorrel seed meal

Parameters	Levels of replacement of raw sorrel seed meal for soybean meal (%)					
	0	25	50	75	100	SEM
Live weight (g)	2175.65	2130.14	2100.00	1990.13	1760.43	97.68NS
As percentage of Live weight						
Carcass	70.11	71.39	71.35	68.35	63.95	3.63^{NS}
Drumstick	10.04	9.36	10.32	11.16	8.44	0.52^{NS}
Thighs	14.22	12.87	11.77	12.42	11.90	0.43^{NS}
Wings	3.98	4.18	4.30	4.43	4.37	0.11^{NS}
Breast	16.87^{b}	17.38^{ab}	19.23^{a}	18.40^{ab}	21.75^{a}	0.62*
Abdominal fat	1.33^{a}	1.22^{b}	1.19^{bc}	1.26^{b}	1.15^{c}	0.12*

a,b.c.d: means within the row bearing different superscripts differ significantly (P<0.05)
*SEM: Sandard error of the means. NS: Not significant (P>0.05). *: significant (P<0.05)*

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