

Growth performance and carcass characteristics of broiler chickens fed raw and differently processed roselle (*Hibiscus sabdariffa* L.) seed meal

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Abstract

One hundred and fifty (150) day-old Abor acre broiler chicks were used for this experiment to assess growth performance and carcass characteristics of broilers fed processed roselle (*Hibiscus sabdariffa*) seed meal were investigated. The birds were randomly assigned to five dietary treatments with three replicates (ten chicks per replicate) each in a completely randomized design (CRD). In the feeding trial, raw roselle seed meal (R_rRSM), roasted roselle seed meal (R_oRSM), boiled roselle seed meal (BRSM) and soaked roselle seed meal (SRSM) were incorporated as part replacement for groundnut cake at 50% level of inclusion. Proximate composition of the processed test ingredients and the results showed that there were no significant ($P > 0.05$) differences among the treatment means. Raw roselle seed meal (R_rRSM) gave the least crude protein while the highest was recorded in boiled roselle seed meal (BRSM). Birds fed diet without roselle seed meal inclusion (control diet) had the best final body weight and feed conversion ratio but not significantly ($P > 0.05$) different from other treatments. Birds in treatments 2 and 4 (R_rRSM and BRSM) had the least survival rate (96.67%) while the rest treatments had 100%. Cut-up parts showed no significant ($P > 0.05$) differences except for the wings of the bird fed roasted roselle seed meal was significantly ($P < 0.05$) different and higher than those fed control, raw, boiled and soaked roselle seed meal (10.87, 7.52, 9.85 and 9.46%, respectively). Results from visceral organs showed no significant ($P > 0.05$) differences except proventriculus which exhibited significant ($P < 0.05$) differences among the treatment means. Proventriculus of bird fed roasted roselle seed meal (R_oRSM) was highest (0.80%) while those fed raw roselle seed meal (R_rRSM) gave the least (0.50%). This study however, revealed that using processed (roasted, boiled and soaked) roselle (*Hibiscus sabdariffa*) seed meal as part replacement for groundnut cake has no deleterious effects on the broiler chickens.

Keywords: Growth performance, carcass characteristics, processed roselle, broiler

Introduction

The growing human population coupled with increase in the demand of foodstuffs has led to increase in demand for protein particularly animal protein. Protein, besides energy sources, constitutes a large amount of the total cost of production in animal husbandry especially during the finishing phase. Competition between humans and livestock for the available foodstuffs have contributed to the high cost of these feeding stuffs and livestock products, and invariably low animal protein intake by the

citizenry. Therefore, there is a need to look inward for alternative feedstuffs that are cheap and locally available to replace the expensive conventional ones in formulating animal feeds.

Roselle (*Hibiscus sabdariffa*) is an annual plant, erect, bushy, herbaceous sub-shrub that can grow up to 2.4 m tall, with smooth or nearly smooth, cylindrical, typically red stems (Aminet *al.*, 2008). Fresh or dried calyces of *Hibiscus sabdariffa* are used in the preparation of herbal drinks, hot and cold beverages, fermented drinks, wine,

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jam, jellied confectionaries, ice cream, chocolates, flavouring agents, puddings and cakes (Okoro, 2007; Ismail *et al.*, 2008; Bako *et al.*, 2009, Bolade *et al.*, 2009). In Africa, the seeds are roasted or ground into powder and used in meals, such as oily soups and sauces. In China and West Africa, the seeds are also used for their oil (Atta and Imaizumi, 2002).

Roselle (*Hibiscus sabdariffa* L.) seed is a valuable food resource due to its richness in protein content and micronutrients. It is also an excellent source of fibre (Omabuwajo *et al.* 2000). Roselle seeds contain 18.3 % of total dietary fibres (Amin *et al.*, 2008). According to Tosh and Yada (2010), the edible seeds from pulses are rich food source of dietary fibres that enhance various health benefits. Dietary fibre present in roselle seeds contribute to physiological and health benefits. Roselle seeds can be considered good ratio of soluble to insoluble fibre fraction (Amin *et al.*, 2008). Chau *et al.* (1997) reported that different cooking methods improve the nutritional quality of food legumes to various extents; and Halimatule *et al.* (2007) reported that the protein quality of dried roselle seeds was similar to that of boiled counterparts, and based on this, the seeds were subjected to different time of boiling before incorporating into the diet of broiler birds.

Materials and Methods

Experimental site

This experiment was carried out at the Teaching and Research Farm of Ibrahim Badamasi Babangida University, Lapai, Niger State, Nigeria. Lapai lies between latitude 9°31' and 9°45', east of equator (Usman, 2013).

Source and processing of ingredients

Fish meal, blood meal, maize, bone meal, limestone, table salt, wheat offal, premix, lysine, methionine and groundnut cake were

purchased from a reputable feed ingredients shop, Minna, Niger State. Roselle seed was obtained from Local market, in and around Lapai, and were divided into four different portions: the first portion was processed by soaking in water for 24 hours, the second portion; was boiled for 30 minutes, the third portion was roasted until the seeds turned brownish, and the fourth portion was left raw.

Experimental birds and management

One hundred and fifty (150) day-old broiler chicks of mixed sexes were used for the experiment. The pen was washed and disinfected two weeks to the arrival of the chicks with litter materials spread on the floor. Feed and water were served immediately the chicks arrived and the temperature of the brooding room was under control. The chicks were randomly assigned into five dietary treatments in a completely randomized design (CRD). Each treatment was replicated thrice with ten (10) chicks per replicate. Chargeable lamps were used as the source of the lighting and charcoal as source of heat. Anti-stress was administered to the birds on arrival and also after every weighing operation. Administration of vaccines (Gumboro and Lasota), and drugs (Neoceryl® and Vitacox®) was oral (via drinking water). Birds were starved of water over-night for vaccine to be administered the following morning.

Experimental diets

Experimental diets were compounded using Roselle seed to replace groundnut cake at 50% inclusion level as source of plant protein. Five diets were compounded which are;

Diet 1 (control) contained groundnut cake as major plant protein source Diet 2 contained 50% groundnut cake and 50% raw roselle seed meal Diet 3 contained 50% groundnut cake and 50% roasted

roselle seed meal Diet 4 contained 50% groundnut cake and 50% boiled roselle seed meal Diet 5 contained 50% groundnut cake and 50% soaked roselle seed meal.

Table 1: Gross composition of experimental starter diet

Ingredients (%) SRSM	Control	RaRSM	RoRSM	BRSM	
Maize	53.41	53.41	53.41	53.41	53.41
Groundnut cake	26.70	13.35	13.35	13.35	13.35
Roselle Seed Meal	-	13.35	13.35	13.35	13.35
Wheat offal	10.00	10.00	10.00	10.00	10.00
Fish meal	3.00	3.00	3.00	3.00	3.00
Blood meal	3.00	3.00	3.00	3.00	3.00
Bone meal	2.40	2.40	2.40	2.40	2.40
Limestone	0.80	0.80	0.80	0.80	0.80
Table salt	0.25	0.25	0.25	0.25	0.25
*Premix	0.25	0.25	0.25	0.25	0.25
L-Lysine	0.10	0.10	0.10	0.10	0.10
DL-Methionine 0.10	0.10	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00	100.00
Calculated:					
CP(%)	23.08	22.51	22.78	23.05	22.78
ME(kcal/kg)	2863.66	2916.15	2901.43	2911.12	2901.06

*Flomix Mineral-Vitamin premixes of 0.25kg contains vitamin A 10,000mg, Vitamin D₃ 2,000mg, Vitamin B₁ 500mg, Vitamin B₂ 5,000mg, Vitamin B₆ 300mg, Vitamin B₁₂ 10,000mg, Pantothenic Acid 10,000mg, Niacin 25,000mg, Folic Acid 1,000mg, Biotin 100,000mcg, Choline 150,000mg, Antioxidant 125,000mg and minerals such as Manganese 10,000mg, Zinc 50,000mg, Cobalt 250mg, Iron 40,000mg, Copper 6,000mg, Iodine 500mg and Selenium

R_aRSM= Raw roselleseedmeal, R_oRSM = Roasted roselle seed meal, BRSM= Boiled roselleseed meal, SRSM = Soaked roselle seed meal.

Table 2: Gross composition experimental finisher diet

Ingredients (%) SRSM	Control	RaRSM	RoRSM	BRSM	
Maize	56.32	56.32	56.32	56.32	56.32
Groundnut cake	24.78	12.39	12.39	12.39	12.39
Roselle Seed Meal	-	12.39	12.39	12.39	12.39
Wheat offal	10.00	10.00	10.00	10.00	10.00
Fish meal	3.00	3.00	3.00	3.00	3.00
Blood meal	2.00	2.00	2.00	2.00	2.00
Bone meal	2.40	2.40	2.40	2.40	2.40
Limestone	0.80	0.80	0.80	0.80	0.80
Table salt	0.25	0.25	0.25	0.25	0.25
*Premix	0.25	0.25	0.25	0.25	0.25
L-Lysine	0.10	0.10	0.10	0.10	0.10
DL-Methionine 0.10	0.10	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00	100.00
Calculated:					
CP(%)	21.68	21.03	21.28	21.52	21.28
ME(kcal/kg)	2879.95	2928.68	2915.01	2924.01	2914.67

*Flomix Mineral-Vitamin premixes of 0.25kg contains vitamin A 10,000mg, Vitamin D₃ 2,000mg, Vitamin B₁ 500mg, Vitamin B₂ 5,000mg, Vitamin B₆ 300mg, Vitamin B₁₂ 10,000mg, Pantothenic Acid 10,000mg, Niacin 25,000mg, Folic Acid 1,000mg, Biotin 100,000mcg, Choline 150,000mg, Antioxidant 125,000mg and minerals such as Manganese 10,000mg, Zinc 50,000mg, Cobalt 250mg, Iron 40,000mg, Copper 6,000mg, Iodine 500mg and Selenium

R_aRSM= Raw roselleseedmeal, R_oRSM = Roasted roselle seed meal, BRSM= Boiled roselleseed meal, SRSM = Soaked roselle seed meal.

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Data collection

The following parameters were measured from data generated from weekly recordings during the feeding trials: feed intake, body weight gain, feed conversion ratio, and survival percentage according to the methods adopted by Ari *et al.* (2011). The chicks were weighed at the beginning of the study to determine initial body weight. Feed intake was recorded on weekly basis and was calculated as total feed offered minus the left over. The birds were weighed on weekly basis and the body weight gain was calculated as final weight minus initial weight. Feed conversion ratio was calculated as the ratio of feed consumed and weight gained. That is:

$$\text{Feed conversion ratio} = \frac{\text{feed consumed (g)}}{\text{Weight gained (g)}}$$

At the end of the feeding trial (56 days), six birds per treatment (two birds per replicate) were selected randomly and starved overnight (feed starvation) and slaughtered for carcass evaluation according to (Jourdians, 1980). The cut up parts (breast region, back region, drum sticks, thighs, wings), and visceral organs (liver, spleen, kidney, heart, gizzard, abdominal fat, and pancreas) were weighed. Data collected were subjected to analysis of variance (ANOVA), using Genstat (2011).

Results and Discussion

Table 3 showed the chemical composition of raw and processed roselle seed meal used in this experiment. Dry matter (%DM) values ranged from 88±0.03 to 99±0.02,

crude protein (%CP) ranged from 22±1.00 to 26±1.00, ether extract (%EE) from 19±1.00 to 22±0.99, crude fibre (%CF) ranged from 19±1.00 to 23±0.02, ash (%) values ranged from 4.3±1.00 to 5.9±0.02, Nitrogen Free Extract (%NFE) ranged from 26.50 to 31.70, while Metabolizable energy ranged from 3162.99 to 3273.24 kcal/kg. There were no significant ($P>0.05$) differences in all the parameters considered. Nevertheless, crude protein values obtained from this study were higher than 19.54 – 23.43% reported by Ari *et al.* (2014), but lower than those (37.40 – 38.59%) reported by Kwariet *et al.* (2011). Mukhtar (2007) reported 11.98% for crude fibre of roselle seed which is lower than the values obtained from this study. Ether extract values were very close to 22.1% reported by Hainida *et al.* (2008). Metabolizable energy recorded in this study were lower than the report (3486.50 – 3563.04kcal/kg) of Kwari *et al.* (2011) for processed roselle seed meal.

Table 4 showed performance of broiler chickens fed differently processed roselle seed meal. Initial weight, final weight, feed intake, body weight, feed conversion ratio and survival percentage were the parameters measured. Effect of different processing methods of roselle seed differed significantly in the measured parameters. Birds fed raw roselle seed meal (RaRSM) recorded the lowest (1130g) final weight. This might be connected to the presence of anti-nutritional factors in raw seeds which might have affected their weights.

Table 3: Chemical composition of roselle seed meal used in this study

Nutrients (%)	RaRSM	RoRSM	BRSM	SRSM
Dry matter	90±0.04	99±0.02	95±0.02	88±0.03
Crude protein	22±1.00	24±1.10	26±1.00	24±1.10
Ether extract	22±0.99	19±1.00	19±1.00	21±0.16
Crude fibre	20±0.96	20±1.00	19±1.00	23±0.02
Ash	5.7±0.03	5.9±0.02	4.3±1.00	5.5±1.02
Nitrogen free extract	30.30	31.10	31.70	26.50
ME (kcal/kg)	3273.24	3162.99	3235.56	3160.20

Metabolizable energy: ME (kcal/kg) = 432+27.91[CP+NFE+2.25(EE)] according to Steel and Torrie (1980)

Table 4: Performance indices of broiler chickens fed raw and processed test ingredient

Parameter (g/b)	Control	RaRSM	RoRSM	BRSM	SRSM	SEM
Initial weight	50.00	50.20	50.00	49.70	50.00	1.81
Final weight	1500.00	1130.00	1370.00	1300.00	1300.00	7.52
Body weight gain	1450.00	1079.80	1320.00	1250.30	1250.00	3.56
Feed intake (g/b/d)	233.33	259.26	227.67	259.26	233.33	7.00
Feed conversion ratio	0.16	0.24	0.17	0.21	0.19	18.74
Survival (%)	100.00	96.67	100.00	96.67	100.00	12.62

RRSM = Raw roselleseed meal, RRSMB= Roasted roselle seed meal, BRSM= Boiled roselle seed meal, SRSM= Soaked roselle seed meal, SEM= standard error mean

Table 5: Cut-up parts of broiler chicken fed processed roselle seed

Parameter (%LW)	Control	RaRSM	RoRSM	BRSM	SRSM	SEM	LSD
Head	2.51	2.47	2.47	2.84	3.11	1.81	4.18
Neck	4.72	4.29	6.51	4.78	4.39	7.52	17.35
Shank	3.60	3.75	4.54	3.89	4.01	3.56	8.22
Drumstick	8.01	7.25	10.30	8.19	8.35	7.00	16.15
Breast	10.02	8.88	10.92	10.55	10.85	18.74	43.21
Back	10.61	11.08	12.21	14.12	12.93	12.62	29.14
Thigh	9.17	9.26	11.74	10.90	10.57	14.56	33.58
Wing	10.87 ^b	7.52 ^d	12.47 ^a	9.85 ^{bc}	9.47 ^c	13.58	31.32*

RRSM = Raw roselleseed meal, RRSMB= Roasted roselle seed meal, BRSM= Boiled roselle seed meal, SRSM= Soaked roselle seed meal, SEM= standard error mean, LW= Live Weight, * = significant

Table 6: Visceral organs of broiler chicken fed different processed roselle seed

Parameter (%LW)	Control	RaRSM	RoRSM	BRSM	SRSM	SEM	LSD
Heart	0.57	0.51	0.73	0.65	0.59	0.74	1.70
Gizzard	2.93	3.01	4.00	3.50	3.10	3.37	7.78
Liver	2.79	2.52	3.76	3.20	2.90	3.28	7.56
Spleen	0.13	0.13	0.18	0.52	0.12	0.36	0.82
Proventriculus	0.58 ^b	0.50 ^b	0.80 ^a	0.71 ^a	0.27 ^c	0.66	1.51*
Abdominal fat	1.11	1.24	1.73	1.42	1.16	3.76	8.67
Pancreas	0.37	0.26	0.36	0.28	0.31	0.70	1.60
Intestine	7.72	7.69	9.97	9.68	10.05	11.38	26.24
Kidney	0.52	0.48	0.69	0.52	0.61	1.55	3.57

RaRSM= Raw roselle seed meal, RRSMB= Roasted roselle seed meal, BRSM= Boiled roselle seed meal, SRSM= Soaked roselleseed meal, SEM= standard error mean, LW= Live Weight, * = significant

Results obtained for relative cut-up parts (head, neck, drumstick, thigh, back, breast and shank) in Table 5, showed that there were no significant ($P > 0.05$) differences. However, the value (12.47%) obtained for wings of the bird fed roasted roselle seed meal was significantly ($P < 0.05$) different and higher than those fed from raw, boiled and soaked (7.52, 9.85 and 9.46%), but very

close to that fed from control (10.87%). The least value (7.52%) was obtained from the wing of birds fed with raw roselle seed meal. This result is centrally to the finding of Stephen *et al* (2014), who reported significant difference in weight of the parameters. However, the result is also in line with the findings of Duwaet *et al* (2012) who revealed that there were significant

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($P > 0.05$) differences in the weights of wings across the treatments.

Table 6 showed results of visceral organs (heart, gizzard, liver, spleen, kidney, abdominal fat, pancreas and intestine). There were no significant ($P > 0.05$) differences among the organs. However, there were significant ($P < 0.05$) differences in the proventriculus of the birds across the treatment means. The highest value (0.80%) was obtained from the proventriculus of the birds fed roasted seed meal, while the least (0.50%) was recorded by birds fed raw roselle seed meal. Results from this study was contrary to the findings of Stephen *et al.*, (2014) who reported significant ($P < 0.05$) differences in the weights of gizzard and pancreas. Notwithstanding, results obtained for proventriculus is in agreement with the report of Awodola *et al* (2015) that there were significant ($P < 0.05$) differences in the weights of proventriculus.

Conclusion

Results from this study indicated that processed roselle seed meal could serve as a source of plant protein in broiler diets. It also showed that processed roselle seed meal, especially roasted, can be used to replace 50% groundnut cake without any harmful effects on broiler chicken.

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