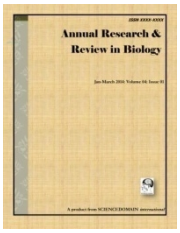

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Carcass Characteristics, Organ Morphology and Serum Profile of Broiler Chickens Fed Differently Processed Roselle Seeds (*Hibiscus sabdariffa*)

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Author's contribution

The whole work was carried out by the author MMA.

Original Research Article

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ABSTRACT

Aim of Study: To determine the effect of different processing methods of Roselle seeds on carcass characteristics, organ morphology and serum profile of broiler chickens
Study Design: A total of 135 Anak day-old broiler chicks were randomly assigned to three (3) experimental groups of three (3) replicates using completely randomized design to evaluate the effect of inclusion of differently processed Roselle seeds on carcass traits and serum indices of experimental birds. Data collected were subjected to ANOVA.
Place and Duration of Study: Livestock Complex, College of Agriculture, Lafia, Nasarawa state, Nigeria: February 2012 to April 2012.
Methodology: A total of 135 number Anak day-old broiler chicks were randomly divided into three (3) experimental groups of three replicate each. Dietary treatments were as follows: D1, D2 and D3 representing Crushing of Raw Rosselle Seeds (CRRS); Hydrothermally Processed Rosselle Seeds (HTRS) and Fermented Rosselle Seeds (FRS) base diets at both starter(1- 28 d) and finisher phases(29- 50 d).
Results: The results obtained showed no significant (P=0.05) differences in the live weight, plucked weight and plucked weight percentage. However, carcass weight, carcass weight percentage and the following cut up parts; head, shank, neck, and back varied significantly (P=0.05). Variations (P=0.05) were recorded in the thigh, scubbed fat, gastro intestinal

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length (GIT) and gizzard weight of broilers fed experimental diets. The carcass weight and the primal cuts values (breast, thighs, drumstick and back) were best in D3 (1432.50g, 22.72g, 48 03g and 25.07g respectively) while scubbed fat and intestinal length were lowest with the same D3 group birds.

Conclusion: Roselle seeds can be added in broiler diets up to 25% without necessitating processing. However, fermentation showed significant improvement in carcass weight, primal cut up parts as well as reduced scrubbed fat and serum cholesterol when compared with crushing of raw seeds and hydrothermal processing methods.

Keywords: Broilers; rosselle seeds; carcass traits; serum Profile.

1. INTRODUCTION

The nutritional potentials of Roselle seeds (*Hibiscus Sabdariffa*) as an alternative protein source in the diets of monogastrics and human in developing countries like Nigeria have been highlighted [1,2]. Broilers are the most efficient in converting raw feed stuffs and by-products into high protein food which is urgently needed to improve the nutritional standards of humans [3].Therefore, this unconventional oilseed reported to have readily available nutrients, particularly digestible protein (DP) and digestible energy (DE) [4, 5] is a good substitute for conventional oilseeds.. Roselle seeds were also reported [6] to be economically efficient plant protein source that could be included in broiler diets when supplemented with enzymes.

The main nutrients in Roselle seeds include protein from amino acids and oil from fatty acids. The values of Roselle seed fats (palmitic, oleic, linoleic acid and stearic acids) were considerably better when compared with other seeds [7]. However the composition of ash, fibres and other nutrients differ between Roselle cultivars.

The use of carcass characteristics, organ morphology and serum profile in evaluating the nutritional qualities of feeds and feed processing methods have been reported [1,8,2,9]. This study was therefore designed to determine the effect of different processing methods of Roselle seeds on carcass characteristics, organ morphology and serum profile of broiler chickens

2. MATERIALS AND METHODS

2.1 Experimental Site

This study was conducted at the Livestock Complex of College of Agriculture, Doma Road, Lafia which is located between latitude 8º and 9º North and longitude 80º and 90º East. The minimum temperature is 21.9ºC and maximum temperature of 37.6ºC between January to June and the average annual rainfall is 823mm. The test ingredients were processed at both the Livestock Complex and the Nutrition Laboratory of the college while the final feed was compounded at the feed mill unit of the complex.

2.2 Roselle seed Collection, Processing and Diet Preparation

Roselle seeds *(Hibiscus Sabdariffa)* was procured from a local market in Langtang South of Plateau State, Nigeria. The collected seeds were cleaned by winnowing and hand picking of

stones and debris. The raw Roselle seeds were subjected to three processing methods viz: crushing of raw Roselle seeds (T1), hydrothermal (T2) and fermentation (T3). Each of these processing methods of Roselle seed served as test ingredient and was used as a replacement of soyabean meal in the broiler diets representing experimental treatment groups. The different processing methods of Roselle seed are described as thus:

2.2.1 Crushing of raw rosselle seeds (CRRS) - (T1)

Roselle seeds were cleaned by removing dust, stones and plant debris. The seeds were milled using a laboratory scale hammer miller and sieved through a 30mm mesh screen according to the methods described by [10]. The milled and bagged Roselle seeds represent experimental treatment (1) (CRRS).

2.2.2 Hydrothermally processed roselle seeds (HTRS) –T2

The method adopted by [11] was used. The cleaned seeds were poured into aluminum tower pot containing 50 litres of clean water in a batch of 50 Kg. The Roselle seeds were allowed to boil at 100ºC for 30 minutes before cooling by spreading on jute bags until stable weight was attained at room temperature. The cooked, milled and bagged Roselle seeds represent experimental treatment (2) (HTRS).

2.2.3 Fermented roselle seeds (FRS) –T3

The raw Roselle seeds were sorted to ensure cleaned grains. The cleaned Roselle were poured into a drum of 50 litres of boiling water per batch of 50kg Roselle seeds and allowed to boil at 100ºC for 30 minutes according to the method described by [12]. The boiled seeds were drained, cooled to room temperature and placed in a leaf-lined basket covered with further leaves and kept for 48 hours. The products were sun dried and milled. The Fermented, milled and bagged Roselle seeds represent experimental treatment (3) (FRS).

2.3 Experimental Treatment

A total of 135 Anak day-old broiler chicks were randomly divided into three (3) experimental groups of three replicates each. Dietary treatments were as follows: D1, D2 and D3 which had: Crushing of Raw Roselle Seeds (CRRS); Hydrothermally Processed Roselle Seeds (HTRS) and Fermented Roselle Seeds (FRS) as replacement of soyabeans at both starter and finisher phases using completely randomized design having the test ingredients incorporation as the main source of variation. The starter diets were fed for four (4) weeks (1- 28 d) brooding phase and the finisher diets were fed for three (3) weeks (29- 50 d). The experimental feeds were formulated using a least cost feed formulation software *Feedwin*.

3. DATA COLLECTION

3.1 Carcass Evaluation and Gut Morphology

A total of 5 birds were randomly selected from each of the replicate groups and fasted (no limitation of water access) for 8 h prior to complete carcass evaluation according to methods adopted by [9].

3.2 Chemical and Serum Analysis

Chemical composition of each of the Roselle seeds treated samples and experimental diets were determined following standard methods [13] while the serum parameters were determined by the methods adopted by [14].

4. STATISTICS

Data collected were subjected to One-way Analysis of Variance (ANOVA), means were separated (P>0.05) where there were significant differences using Duncan's Multiple Range Test [15] using SPSS 16.0 [16].

5. RESULTS

Table 1 presents the chemical composition of the crushed, boiled and fermented Roselle seeds. Dry matter (DM) values ranged from 90.40 to 91.39% respectively for hydrothermal and crushed seeds while crude protein (CP) ranged from 19.54% to 23.43% for crushed and fermented seeds respectively. Crude fibre (CF) on the other hand had values ranging from 3.30% to 4.52 % for fermented and crushed seeds respectively. The highest value of ether extract (EE) was obtained in fermented Roselle (6.58%) while the least (5.70 %) was obtained in crushed seeds. Total ash ranged from 5.39% to 6.94% while total carbohydrates expressed as nitrogen free extract (NFE) ranged from 50.43 to 55.36 %. The highest calcium (Ca) and phosphorous (P) values were 1.12 and 0.56% in hydrothermal and fermented Roselle seeds respectively. These findings are similar to the chemical composition of Roselle seeds reported by [18], [19] and [7].

Table 1. Effect of processing on the Chemical composition of Roselle (*Hibiscus sabdariffa*) Seeds

	Chemical composition (%)							
Methods of Processing	**Dry Matter**	**Crude Protein**	**Crude Fibre**	**Ether Extract**	**Total Ash**	**NFE**	**Ca**	**P**
Crushing of raw seeds	91.39	19.54	4.52	5.70	6.27	55.36	0.71	0
Hydrothermal	90.40	21.84	3.60	5.85	5.39	53.72	1.12	0
Fermentation	90.68	23.43	3.30	6.58	6.94	50.43	0.30	0

Table 2 presents the composition of the experimental diets. The experimental diets are within recommended range [19]. The variations in the nutrient composition of the experimental diets at both starter and finisher phases were also within recommended range for birds in the tropics as reported by [20].

Table 2. Composition of Experimental Diets

	Starter phase			Finisher phase		
Maize	27.00	27.00	27.00	34.00	34.00	34.00
Maize Bran	3.25	4.00	4.00	3.25	3.25	3.25
Cassava	14.50	14.50	14.30	14.45	14.45	14.45
Soya toasted	18.55	17.80	18.00	13.00	13.00	13.00
CRRS	25.00	-	-	23.00	-	-
HTRS	-	25.00	-	-	23.00	-
FRS	-	-	25.00	-	-	23.00
Blood Meal	2.00	2.00	2.00	3.50	3.50	3.50
Fish Meal	5.00	5.00	5.00	3.00	3.00	3.00
Bone Meal	3.50	3.50	3.50	3.50	3.50	3.50
Palm Oil	0.50	0.50	0.50	1.60	1.60	1.60
L-Lysine	0.10	0.10	0.10	0.10	0.10	0.10
DL-Methionine	0.10	0.10	0.10	0.10	0.10	0.10
Salt	0.25	0.25	0.25	0.25	0.25	0.25
Premix*	0.25	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100	100
****Calculated**						
ME/Kcal/kg	3126.85	3112..95	3104.7	3193.08	3185.74	3177.18
CP%	21.15	21.50	21.97	19.37	19.90	20.26
Determined analysis						
D M (%)	92. 73	92. 78	92. 69	92.95	93.43	92.83
CP (%)	21.05	21.33	21.73	19.83	19.95	20.17
CF (%)	4.82	4. 38	4.36	4.71	4.34	4.39
EE (%)	7.71	7.64	8.02	8.62	8.42	8.84
T Ash (%)	14.67	15.19	15.23	10.31	9.96	10.26
Ca	1.10	1.15	1.06	0.98	1.06	0.97
P	0.77	0.79	0.79	0.68	0.71	0.68
NFE (%)	43.93	43.04	34.08	49.48	50.76	49.17

**Premix to provide the following per KG of diet: Vitamin A, 9,000 IU; Vitamin D3, 2,000,IU; vitamin E, 18 IU; vitamin B1, 1.8 mg; vitamin B2, 6.6 mg B2,; vitamin B3, 10 mg; vitamin B5, 30 mg; vitaminB6, 3.0 mg; vitamin B9, 1 mg; vitamin B12, 1.5 mg; vitamin K3, 2 mg; vitamin H2, 0.01 mg; folic acid, 0.21 mg;nicotinic acid, 0.65 mg; biotin, 0.14 mg; Choline chloride, 500 mg; Fe, 50 mg; Mn, 100 mg; Cu, 10 mg; Zn, 85 mg;I, 1 mg; Se, 0.2 mg.*

*** Calculated using feedwin software*

****DM (Dry Matter); CP (Crude Protein); CF (Crude Fibre); EE (Ether Extract); T Ash (Total Ash); Ca (calcium); P (phosphorous); NFE (Nitrogen Free Extract)*

The effect of different treatment of Roselle seeds on the carcass characteristics and organ morphology of the experimental birds is presented in table 3. There were no significant (*P*=0.05) differences in the live weight, plucked weight and plucked weight percentage. Carcass weight, carcass weight percentage and the following cut up parts; head, shank, neck, and back varied significantly (*P*=0.05) among processed broilers. Significant (*P*=0.05) differences were recorded in the thigh, scubbed fat and the following organs; gastro intestinal length (GIT) and gizzard weight of broilers fed experimental diets. The carcass weight and the primal cuts values (breast, thighs, drumstick and back) were best in D3

(1432.50g, 22.72g, 48 03g and 25.07g respectively) while scubbed fat and intestinal length were lowest with the same D3 group birds.

Table 3. Effect of processing of Roselle (*Hibiscus sabdariffa*) seeds on the carcass Characteristics and organ morphology

	D1	D2	D3	SEM
Live weight (g)	2012.50a	2100.00a	2112.50a	±15.73
Plucked weight (g)	1850.00a	1887.50a	1912.50a	±9.08
Pluck weight (%BW)	91.88a	91.05a	90.78a	±0.27
Carcass weight (g)	1400.00c	1420.00b	1432.50a	±4.86
Carcass (%BW)	74.35c	75.84b	76.21a	±0.28
Head(g)	2.74b	2.67b	3.18a	±0.08
Shank (g)	5.11c	5.29b	5.45a	±0.05
Drumstick(g)	4.24a	4.37a	48 03a	±0.30
Breast (g)	20.40c	21.13b	22.72a	±0.34
Neck (g)	5.30c	6.14b	6.50a	±0.18
Back (g)	18.25c	18.50b	18.95a	±0.10
Thigh (g)	22.92a	24.55a	25.07a	±0.32
Organs				
Scrubbed fat (g)	10.15c	8.87b	5.17a	±0.75
GIT length(cm)	78.00a	65.00b	64.17b	±2.25
Gizzard(g)	3.97c	7.80a	6.50b	±0.56

Abc means in the same row with the same superscript are not significantly (P>0.05) different
SEM Pooled Standard Error of Mean
BW Body weight

The biochemical and haematological indices of the experimental birds is presented in table 4. There were no significant (*P*=0.05) differences in the values recorded for glucose, protein, urea, cholesterol and creatine among dietary treatment groups. Similarly PCV, Hb, WBC and MCV did not vary significantly with dietary treatment.

Table 4. Effect of processing of Roselle (*Hibiscus sabdariffa*) seeds on some Biochemical and haematological parameters of broilers

	D1	D2	D3	SEM
Glucose	10.10a	8.40a	7.90a	±0.33
Protein(g/dl)	56.70a	50.10a	51.30a	±1.01
Urea(mmol/L)	3.10a	2.90a	2.80a	±0.04
Cholesterol (mmol/L)	3.30a	3.32a	3.41a	±0.03
Creatine (mn/l)	61.60a	62.30a	6.20a	±9.29
PCV(%)	30.00a	31.00a	29.00a	±0.29
Hb (g/dl)	10.00a	11.00a	10.10a	±0.16
WBC count ($X10^3/mm^3$)	110.00a	98.00a	154.00a	±8.51
MCV(fl)	128.00a	124.00a	127.00a	±0.60

Abc means in the same row with the same superscript are not significantly (P=0.05) different
SEM Pooled Standard Error of Mean

6. DISCUSSION

The observed similarities in carcass characteristics were as a result of nutrient balance in the experimental feeds which were within recommended range for broilers [19] and the nutrient constituents [7]. Organ weights and GIT length of birds in the different dietary treatment group was similar to those earlier reported [21,11]. The low abdominal fat deposition recorded in all the dietary treatment groups showed the potentials of Roselle seeds utilization in broilers diets. The observed differences in intestinal size measurement between D1 and D3, D2 groups fed boiled and fermented Roselle seeds based diet can be associated with processing which reduces anti nutritional factors in Roselle [4,10,7]. The reduction in competition between hosts microorganisms and pathogenic microbes associated with GIT of broilers fed fermented products [22,14,12] usually results in reduced inflammation of the GIT and transit time of feed in the GIT. Therefore the GIT length of birds fed fermented feed products are shorter as observed in this study.

The biochemical and hematological values for all the dietary treatment groups are comparable to those reported for broilers [1]. This confirms the nutritional adequacy of the experimental diets. The reduction in the serum cholesterol observed for all the dietary treatments provides an added advantage as this was reported to lower cholesterol deposition in broilers [23,1,24,2]. The effect of fermentation in reducing serum cholesterol as observed by [14] is also observed in D3 group.

7. CONCLUSION

The results obtained in this study showed that the Roselle seed is a rich source of nutrients that provides useful replacement of conventional oilseeds in broiler feeds even without processing. Fermentation of Roselle *(Hibiscus sabdarif)* however provided a better and effective mechanism for the improvement in carcass and morphological traits as well as serum biochemistry of broilers. The activity of Bacillus species predominantly associated with traditional fermentation of Roselle and possible enzymatic activity during the fermentation process (lipolysis, proteolysis and carbohydrates degradation of carbohydrates) may have resulted in the nutritional improvement of the fermented Roselle seeds. These combined activities impact on some polyphenols and phytic acid content of Rosselle seeds and most have supported nutrients bioavailability to birds fed fermentation base diets. [24].

COMPETING INTERESTS

Author has declared that no competing interests exist.

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