

## Research Article

# EFFECTS OF FEEDING RATIONS WITH VARYING LEVELS OF ROSELLE (HIBISCUS SABDRIFFA L) SEEDPOWDER ON BROILER CHICKS PERFORMANCE, CARCASS AND SOME INTERNAL ORGANS CHARACTERISTICS

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## ABSTRACT

This study was conducted to evaluate the effects of feeding broiler chicks with rations containing four different levels of Roselle seed powder (0, 5, 10 and 15%) as a source of protein on their performance, of the chicks, carcass and some internal organs characteristics. Sixty chicks were randomly distributed into four groups each with five birds of tree replicates penned with water and feed provided continuously. The rations were prepared to meet chickens' requirements, according to NRC, (1994) with equal energy and protein contents. Chicks were weighed and feed intake was determined weekly. The birds and consumed feed were weighed weekly together with weight gain and feed conversion ratio were calculated from that data. By the end of the fifth week, one chick was randomly selected from each replicate (three chickens per treatment), slaughtered and the length of intestine was measured. The weight of the liver, the weight of abdominal fat, the heart, the thigh, the neck, back, chest and wings was obtained. The experimental data was analyzed using analysis of variance and differences among treatment means were detected using least significant difference test (LSD). The results showed no significant differences ( $P>0.05$ ) in general performance where the body weight gain was found being 1724, 1933, 1837 and 1768.7 for the group I, II, III, and IV, respectively. As the results showed no significant differences ( $P>0.05$ ) that could be attributed to addition of the Hibiscussabdariffa seed powder for dressing percentage where the groups recorded 0.73, 0.70, 0.71 and 0.72% for group I, II, III, and IV, respectively. Feed conversion ratio was  $1.55 \cdot 1.59 \cdot 1.42 \cdot 1.61$  for I, II, III, and IV respectively. The final weights were 1785, 1893.3, 1898.3 and 1830 g / chick for the group IV, III, II, I respectively. The commercial cuts were also similar for the four groups as well as the internal organs. It was concluded that the replacement of groundnut seed cake with Roselle seed powder did not affect the performance of the chick, carcass characteristics and internal parts hence it could be used to reduce the cost feeding. The study recommended replacement of groundnut seed cake with higher levels of Roselle seed powder and study effects of replacement on chicks performance.

**Keywords:** Broiler performance, Carcass characteristics, feed, Roselle seeds.

## INTRODUCTION

Success of poultry industry depends on good management, good hygiene and economic sufficient feed. Poultry industry in the Sudan through production egg and meat has shown considerable expansion in recent years. Poultry meat production from commercial hybrid broiler started in 1979 by the Sudanese Kuwaiti poultry project. Thereafter progressive increase in production occurred through years by establishment of other similar projects. Economically .poultry meat production is of extreme importance because it can replace sizeable part of red meat that is locally consumed for export .The aim of broiler production is to maximize revenue over and above fixed production costs. This is not attained under the present Sudan condition especially because of the high feed costs. Nevertheless feed price that constitutes about 70-85% can be reduced using cheap and locally available ingredients. Feeds that are not competed for between human and animals and always available unlike scarce crop production and in high demand due to human population growth (Mukhtar and Bakheit, 2012). Protein and energy are the most costly components in poultry diets, especially the plant protein (Mukhtar, 2007). Indeed most of this cost is approximately due to the heavy

dependence on cereal crops for energy and the imported super concentrates as source of protein. Also there is an urgent need in industrialized societies to develop novel products .That can lower human dietary cholesterol intake, some needed additives in order to minimize the cost of feeding and sometimes produced healthy and acceptable products to consumers. Roselle seeds powder is one possible source of cheap protein source that can be used in poultry feeding. Moreover Roselle seeds are good source of dietary fiber and minerals such as phosphorus, magnesium and calcium.

## Objective of the study

The overall objective of the study was to reduce chick feed cost using cheap and locally available ingredients. The specific objective was investigating the effects of feeding broiler chicks with rations of different levels of Roselle seed powder on performance, carcass characteristics and some internal organs characteristics.

## MATERIALSAND METHODS

### Study Area

The study was carried out on farm of the Department of Animal Production, Faculty of Natural Resources and Environment Studies University of Kordofan, in El-Obied town that lies at an altitude of 560

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meters above sea level with a mean annual rainfall of 280 mm and mean annual temperature range of 30<sup>o</sup>-35<sup>o</sup>C with peaks of above 40<sup>o</sup>during the months of April, May and June prior to the rainy season and minimum temperatures vary between 18<sup>o</sup>-22<sup>o</sup>C during winter, which extends from November to February. The rainy season extends from July to October with the greatest monthly rainfall in August (Techno-serve, 1987). Sheikan locality that encompasses Elobeid town has an area of 800km<sup>2</sup> and a population of about 0.5 million persons according to the 1993 national census. The locality represents the urban center of Kordofan region, as it encompasses the town of El-Obied, the regional capital and the second largest agricultural market in the country. Kordofan is a vast semi- arid region in western Sudan extending to about 400000<sup>2</sup> km, or 16% of the country total area, falling within the dry savannah ( latitudes 11<sup>o</sup>-16<sup>o</sup>:16<sup>o</sup>-30<sup>o</sup>N, Longitudes 27<sup>o</sup>-32<sup>o</sup>E). The region has been characterized by precarious environmental conditions. Sheikan lies on the poorer portion of the region with an annual rainfall of less than 300 mm and hence marginally cultivated(MOA 1995).

The area is characterized by undulating sand dunes inter mingled by spots of compacted clay soil locally termed as guarded which is hard to cultivate by hand tools (MOA,1995). the dominant vegetation is varying moisture of grasses and herbs with scattered bushes intersected with bare area (Techno serve 1987).

### Experimental birds

Sixty Birds one-day old, unsexed commercial Broiler chicks (Ross) were obtained for the experiment. Upon arrival, all chicks were assigned to the basal diet for two days as adaptation period. Thereafter they were randomly distributed into 12pens; five birds per pen. The initial weight of chicks in each pen was determined to ensure similarity. Each group was assigned to one of the four rations prepared containing 0,5,10 or 15% Roselle seeds powder.

The experiment was conducted in an open –sided 12× 6 square meter, 3.5m of height and was situated in an east-west direction. The whole shed was designed and divided into 36 small pens. Sixty watts light bulbs were used in each pen.

### Experimental Diets

Roselle seeds were cleaned and milled by electrical miller and chemically analyzed via approximate analysis. According to the result of approximate analysis, four experimental diets were formulated from local ingredients .The diets wereiso-caloric and iso-nitrogenous with different levels of Roselle seeds powder (0, 5, 10, and 15%). The experimental diets were formulated and adjusted to meet the nutrients requirements of broiler chicks as outlined by National Research council of USA (NRC, 1994).

### Management and Data Collection

Feed and water offered ad libitum, .Body weight and feed intake were determined weekly and feed conversion ratio (FCR) were estimated for the individual replicate of each dietary treatment Mortality was observed and registered throughout the experimental period of five weeks. At the end of experiment, all birds were fasted overnight to evacuate their digestive tract, but allowed to drink water. Two birds from each pen was selected, for organ characteristics determination. The liver, abdominal fat, Heart, wing, chest, back, neck, thigh and gizzard were weighed; the length of intestine and Caecum were measured.

### The Statistical Analysis

A completely randomized design was used in this study with four treatments of experimental diets and replicated three times, with five birds in each replicate. Data obtained from experiment were subjected to analysis of variance according to (Snedecor and Cochran, 1978).Mean were separated by least significant differences (LSD) test.

**Table (1) proximate analysis of Roselle seed meal**

Ingredients	%
Dry mater	93.55
Crud protein	22.2
Crud fiber	13.26
Ash	5.08
Ether extract	10.29
Nitrogen free extractive(NFE)	42.89

**Table (2) Ingredient composition of experimental diets (%)**

Ingredients	Experimental diets on basis of Roselle seeds meal (%)			
	I	II	III	IV
Sorghum	68.5	63	62	62
Groundnut meal	15	14	13	12.5
Wheat bran	8.00	9.5	6.5	2.75
Super concentrate	5.00	5.00	5.00	5.00
Roselle seeds	0	5	10	15
Dicalcim phosphate	2.00	2.00	2.00	1.5
NaCl	0.25	0.25	0.25	0.25
Lysine	0.05	0.05	0.05	0.05
Methionine	0.20	0.20	0.20	0.20
v.oil	1.00	1.00	1.00	1.00

Rations I with 0% II with 5% III with 10% IV with 15% Roselle seeds powder

**Table (3) Calculated and determined chemical composition of experimental diets.**

Items (%)	Roselle seeds meal			
	I	II	III	IV
<b>Calculated composition</b>				
Crude protein	22.9	22.9	22.71	22.9
(ME)kcal/kg	3176.7	3152.5	3152.3	3152.7
Crude fiber	3.43	4.03	4.33	4.62
Lysine	1.2	1.2	1.2	1.12
Methionine	0.65	0.63	0.61	0.60
Calcium	0.98	0.98	0.97	0.86
Available phosphorus	0.74	0.73	0.71	0.60

Rations I with 0% II with 5% III with 10% IV with 15% Roselle seeds powder

## RESULTS

### Feed intake as affected by addition of Roselle seeds

Weekly feed intake of birds as affected by the level of Roselle seeds is presented in table (4). With the exception of second and fifth weeks, non-significant differences were recorded among the four experimental bird groups for feed intake g/bird of broiler chicks. It ranged from 273.67 to 222.67g for the first week, 341.33 to 250 for the 2<sup>nd</sup>wk, 647 to 625.33 for the 3 wk, 577.33 to528 for the 4wk and 821.83 to 1220.9 for the 5 wk.

**Table (4) Effect of different dietary levels of Roselle seeds meal on the weekly feed intake (g) of Ross broiler chicks**

Roselle seeds meal%	Age in weeks				
	1	2	3	4	5
0 %	273.67 <sup>a</sup>	341.33 <sup>a</sup>	647.00 <sup>a</sup>	577.33 <sup>a</sup>	821.83 <sup>a</sup>
5 %	256.33 <sup>a</sup>	317.67 <sup>ab</sup>	698.67 <sup>a</sup>	575.67 <sup>a</sup>	1038.3 <sup>ab</sup>
10 %	248.00 <sup>a</sup>	271.33 <sup>bc</sup>	590.00 <sup>a</sup>	522.67 <sup>a</sup>	966.33 <sup>ab</sup>
15 %	222.67 <sup>a</sup>	250.00 <sup>c</sup>	625.33 <sup>a</sup>	528.00 <sup>a</sup>	1220.9 <sup>a</sup>
Mean	250.17	295.08	640.25	550.92	1011.8
CV%	9.12	8.55	7.43	6.72	11.28

Ross broiler chicks

**Body Weight gain**

Weekly body weight gain of the broiler chicks as affected by the level of Roselle seeds in their rations is presented in table (5). No significant difference ( $P \geq 0.05$ ) in body weight gain that could be attributed to level of Roselle seeds powder in the rations in the first week. Body weight gain ranged from 85.67 to 55.67 for the first week, 178.67 to 131.67 for the second week, 272 to 237.67 for the third week, 502.67 to 420.67 for the fourth and 685 to 923 for the fifth weeks. In week five the first group gained less weight than the other three groups.

**Table (5) Effect of different dietary levels of Roselle seeds meal on the weekly body weight gain (g) of Ross broiler chicks**

Roselle seeds (%)	Initial weight	Age in weeks				
		1	2	3	4	5
0 %	61.00 <sup>a</sup>	85.667 <sup>a</sup>	178.67 <sup>a</sup>	272.00 <sup>a</sup>	502.67 <sup>a</sup>	685.00 <sup>b</sup>
5 %	60.33 <sup>a</sup>	57.33 <sup>a</sup>	111.67 <sup>b</sup>	279.00 <sup>a</sup>	433.33 <sup>a</sup>	951.67 <sup>a</sup>
10 %	62.67 <sup>a</sup>	73.33 <sup>a</sup>	135.67 <sup>b</sup>	206.33 <sup>a</sup>	419.33 <sup>a</sup>	1001.0 <sup>a</sup>
15 %	61.33 <sup>a</sup>	55.67 <sup>a</sup>	131.67 <sup>b</sup>	237.67 <sup>a</sup>	420.67 <sup>a</sup>	923.00 <sup>a</sup>
Mean	61.33	68.00	139.42	248.75	444.0	890.17
CV%	3.82	18.66	9.78	16.82	9.18	10.06

**Feed Conversion Ratio**

Weekly feed conversion ratio is presented in table (6). With the exception of fourth week, non-significant differences were detected among the four experimental rations for feed conversion ratio of broiler chicks. Feed conversion ratio ranged from 1.21 to 1.32 for the first wk, 1.16 to 1.26 for the 2<sup>nd</sup> wk, 2.40 to 2.64 for the 3<sup>rd</sup> wk, 1.91 to 1.90 for the 4<sup>th</sup> wk and 3.24 to 4.01 for the 5<sup>th</sup> wk. In week five feed conversion ratio differed significantly ( $P < 0.05$ ) by level of Roselle seeds in ration. Group three that was on ration with 15% Roselle seeds had the highest value of feed conversion ratio compared to the other groups. In other words they needed more feed per kilogram weight.

**Table (6) Effect of different levels of Roselle powder on weekly Feed conversion ratio (g/bird)**

Roselle seeds (%)	Age in weeks				
	1	2	3	4	5
0%	1.21 <sup>a</sup>	1.16 <sup>a</sup>	2.40 <sup>a</sup>	1.91 <sup>b</sup>	3.24 <sup>a</sup>
5%	1.09 <sup>a</sup>	1.33 <sup>a</sup>	2.67 <sup>a</sup>	2.88 <sup>a</sup>	2.50 <sup>a</sup>
10%	0.98 <sup>a</sup>	1.25 <sup>a</sup>	2.90 <sup>a</sup>	2.00 <sup>b</sup>	3.51 <sup>a</sup>
15%	1.32 <sup>a</sup>	1.26 <sup>a</sup>	2.64 <sup>a</sup>	1.90 <sup>b</sup>	4.01 <sup>a</sup>
Mean	1.15	1.25	2.55	2.17	3.82
CV%	12.16	9.23	21.30	10.48	14.80

**Overall performance**

The overall performance of broiler chick groups as affected by the level of Roselle seeds in their rations is presented in table (7). It was found that feed intake (g/bird), body weight gain (g/bird, feed conversion ratio (kg feed/kg BWG), final Weight, carcass weight (g/bird) and dressing percentage were not significantly ( $P < 0.5$ ) different and affected by the level of Roselle. Feed conversion ratio ranged from 1.55 to 1.61, body weight gain ranged from 1724 to 1768.7 (g), feed intake ranged from 2661.2 to 2846 (g), final weight ranged from 1785 to 1830 (g), carcass weight ranged from 1311 to 1315 (g), dressing percentage ranged from 0.7373 to 0.7187.

**Table (7) Overall performance of broiler chicks fed Roselle seeds meal at different dietary levels**

Roselle seeds meal %	Feed intake (g/bird)	Body weight gain (g/bird)	Feed conversion ratio (g feed/g BWG)	Final Weight	Carcass weight (g/bird)	Dressing percentage
0 %	2661.2 <sup>a</sup>	1724.0 <sup>a</sup>	1.547 <sup>a</sup>	1785.0 <sup>a</sup>	1311.7 <sup>a</sup>	0.7373 <sup>a</sup>
5 %	2886.7 <sup>a</sup>	1933.0 <sup>a</sup>	1.587 <sup>a</sup>	1893.3 <sup>a</sup>	1331.7 <sup>a</sup>	0.7027 <sup>a</sup>
10 %	2598.3 <sup>a</sup>	1835.7 <sup>a</sup>	1.423 <sup>a</sup>	1898.3 <sup>a</sup>	1346.7 <sup>a</sup>	0.7097 <sup>a</sup>
15 %	2846.9 <sup>a</sup>	1768.7 <sup>a</sup>	1.613 <sup>a</sup>	1830.0 <sup>a</sup>	1315.0 <sup>a</sup>	0.7187 <sup>a</sup>
Mean	2748.3	1790.3	1.543	1851.7	1326.3	0.7171
CV%	4.10	7.79	8.66	7.44	7.32	5.51

\*Means with same letter are not significantly different.

**Weight of different cuts of the broiler carcass**

Weight of different cuts of the broiler carcass is presented in table (8). The analysis of variance indicated non-significant difference among different cuts of carcass. Wing ranged from 143.3 to 138.3, chest ranged from 388.3 to 401.67, back ranged from 301.67 to 268.3, neck ranged from 83.33 to 98.33 and thigh ranged from 395 to 410 (g).

**Table (8) Effect of different levels of Roselle seed powder cuts of carcass of Ross broiler chicks**

Roselle seeds %	Wing	Chest	Back	Neck	Thigh
0 %	143.33 <sup>a</sup>	388.33 <sup>a</sup>	301.67 <sup>a</sup>	83.33 <sup>a</sup>	395.00 <sup>a</sup>
5 %	146.67 <sup>a</sup>	403.33 <sup>a</sup>	265.00 <sup>a</sup>	86.67 <sup>a</sup>	430.00 <sup>a</sup>
10 %	143.33 <sup>a</sup>	401.67 <sup>a</sup>	271.67 <sup>a</sup>	86.67 <sup>a</sup>	443.33 <sup>a</sup>
15 %	138.33 <sup>a</sup>	401.67 <sup>a</sup>	268.33 <sup>a</sup>	98.33 <sup>a</sup>	410.00 <sup>a</sup>
Mean	142.92	398.75	276.67	88.750	419.58
CV%	11.11.0	7.56.00	12.520	17.89	9.81

\*Means with same letter are not significantly different.

### The characteristics of the internal organs

Internal organs characteristics are presented in table (9). No significant ( $P < 0.05$ ) differences were observed in the weight of abdominal fat (g), Gizzard weight (g) and heart (g) as well as the length of intestine length (cm) and cecum length (cm) that could be attributed to the level of Roselle seeds in the diet. Abdominal fat ranged from 18.33 to 33.33, gizzard ranged from 31.67 to 33.33, liver ranged from 41.67 to 46.67, heart 10, intestine length 142.33 to 166.67 (cm), Caecum 19 to 18 (cm).

**Table (9). Effect of different levels of Roselle seeds powder on length or weight of some internal organs of broiler chicks**

Roselle seeds meal %	Abdominal fat (g)	Gizzard weight (g)	Liver weight (g)	Heart (g)	Intestine length (cm)	Caecum length (cm)
0 %	18.33 <sup>a</sup>	31.67 <sup>a</sup>	41.67 <sup>b</sup>	10	142.33 <sup>a</sup>	19.00 <sup>a</sup>
5 %	28.33 <sup>a</sup>	33.33 <sup>a</sup>	51.67 <sup>a</sup>	10	171.00 <sup>a</sup>	18.67 <sup>a</sup>
10 %	20.00 <sup>a</sup>	33.33 <sup>a</sup>	46.67 <sup>ab</sup>	10	176.33 <sup>a</sup>	18.33 <sup>a</sup>
15 %	33.33 <sup>a</sup>	31.67 <sup>a</sup>	46.67 <sup>ab</sup>	10	166.67 <sup>a</sup>	18.00 <sup>a</sup>
Mean	25.00	32.50	46.67	10.00	164.08	18.50
CV	26.46	14.04	8.18	0.00	8.94	5.840

## DISCUSSION

### Nutrients contents of the Roselle Seed Powder

The chemical analysis of Roselle seeds meal indicated that it contains crude protein 22.2%, fiber 13.26%, Ether extract 10.29% and Ash 5.08%. No further investigations were made to elucidate contents of the Roselle seeds of amino acids, fatty acids and anti-nutritional factors. More detailed and advanced analyses are needed for this purpose.

### Chick general performance

Feed intake was normal and mortality rate was 1.5%. From the first to second week the birds preferred the control diet with 0% Roselle seeds meal, however during weeks four and five the broiler chicks preferred the dietary treatment with high Roselle seeds meal inclusion, especially in the week five may be due to adaptability of the digestive tract of the birds to consume more quantities of Roselle seeds meal. The drop in the feed intake in the second weeks was significantly different among dietary Roselle seeds an unpalatable taste to the feed and may be Hibiscus seeds contain insoluble fibers (arabin-xylanas 11.98) as reported by Bakheit (1993). The fiber reduces the birds feed intake and thus the rate of growth and nutritional utilization or acid taste and sickly odor to the feed, which consequently inhibited the birds from consuming adequate quantities of feed. Roselle seed oils reported to contain unusual fatty acids namely epoxy-oleic and cyclopropanoid fatty acid, which are found in seed lipids of the order Malvales, that comprise several important sources of food for man and animals. The occurrence of these unusual fatty acids in Rosella seed oil showed variations with the stage of seeds maturity. Gossypol, the phenolic compound which known to cause undesirable physiological effects on non ruminants, such as poultry was found in Roselle seed only as traces. The high nutritive value of Roselle seeds may be due to estrogenic compounds or factors are found generally in Malvaceae (*Hibiscus Sabdriffa* L).

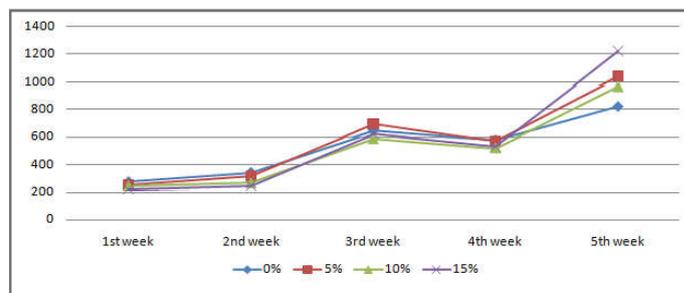
### effects on body weight and feed conversion ratio

Body weight gain increased when increased the levels of Roselle seeds, the highest rate of weight gain in the fifth week in the group 10% Roselle seeds Some workers (Beshir, 1996, Duwaet *al.*, 2012, and Kwariet *al.*, 2010) reported similar trends that agreed with the present results, as they found that the rate of weight gain increased with increased level of the Roselle meal, highest value of feed conversion ratio in the group four with 15% Roselle seeds in week five compared to the other groups which made subordination of Roselle seed content of estrogenic compounds. The plane of nutrition and the nutritive value of ingredients are the major factors affecting the daily feed intake. Dietary Roselle seeds meal had no significant effect on overall broiler chicks' performance. The characteristics of the internal organs such as the increase in the liver weight have show to be concomitant with increase Roselle seeds. caecum length decrease when increase Roselle seeds may be due to high fiber content. The weight of different parts of the broiler meat have shown that the highest wing and chest weight was for the group on a ration with 5% Roselle seeds, the highest back and thigh weight was for the group on 10% Roselle seeds and the highest weight of neck was in group on a ration with 15% Roselle seeds. These results were in agreement with the findings of several other workers; (AbuElgasimet *al.*, 2008, Ashom, 2014, Kwariet *al.*, 2011 and RogaiiaKharif 2016). Supplementation with the Roselle seeds improvement feed especially at 5% level of Roselle seeds. This was in accordance with Kwariet *al.*, (2011). Low mortality % disagrees with Owosiboet *al.*, (2017) and Mukhtar (2007 and Mukhtar and Bakheit 2012) who reported higher mortality % upon supplementation with Roselle seeds.

## CONCLUSION AND RECOMMENDATIONS

The result of this study indicated that:

- Further research is necessary to determine how to increase the nutritive value of Roselle seeds meal for mono gastric animals in view of its relative cheapness and abundance.
- An economical study should be conducted to determine the critical amount of Roselle seed meal added as substitution of other sources.
- It is recommended to use up 15% Roselle seeds meal in broiler diets as a source of plant protein.
- Search is needed to investigate the anti-nutritional factors of seeds.
- Conducting different methods of soaking, fermentation and cooking to treat hibiscus seeds to eliminate of or reduce inhibitory factors.



**Figure (1) Effect of Roselle seeds meal on weekly feed intake(g/bird)**

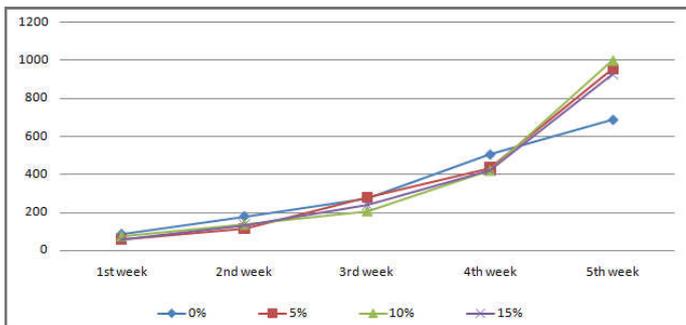


Figure (2) Effect of Roselle seeds meal on weekly body weight gain (g/bird)

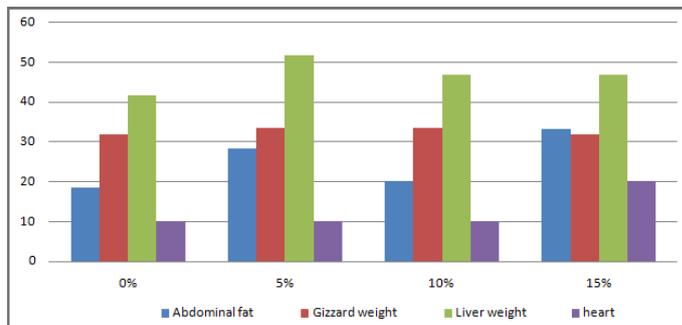
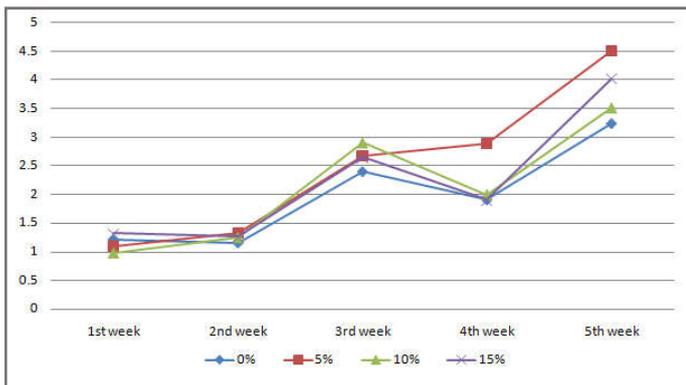


Figure (6) Effect of Roselle seed meal on weight of abdominal fat, Gizzard, Liver and heart



Figure(3) Effect of Roselle seeds meal on weekly feed conversion ratio (feed g / weight)

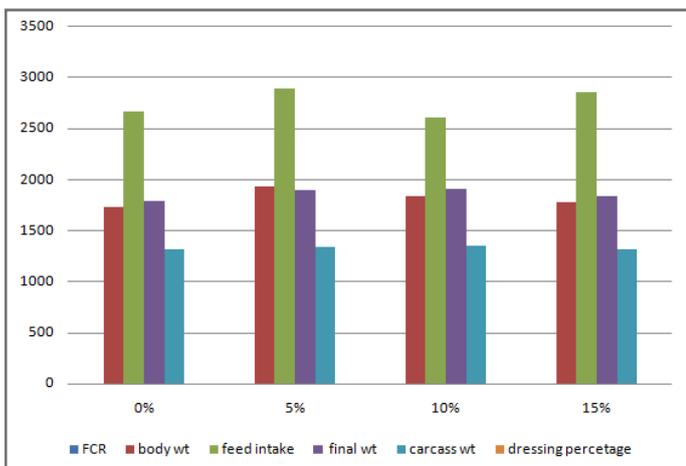


Figure (4) overall performances of broiler chicks fed Roselle seeds meal at different dietary levels

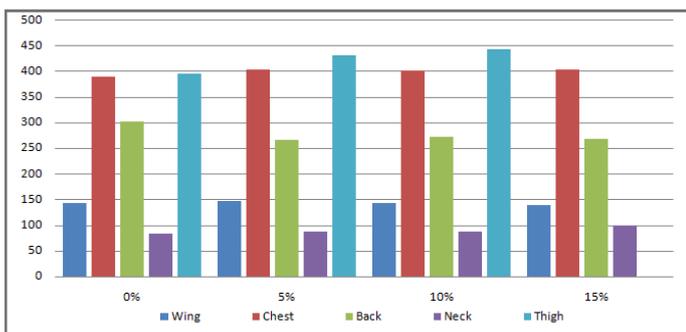


Figure (5) Effects of different dietary levels of Roselle seeds meal on different cuts of carcass of Ross broiler chicks

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