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# Effect of graded levels of raw roselle (*Hibiscus sabdariffa*) seed meal on performance, carcass characteristics and meat quality traits of broiler chicken

[*]Owosibo, A. O., [**] Okere, I. A. and G. A. Adedokun[*]

[*]Department of Animal Production, Federal College of Animal Health and Production Technology, Moor Plantation, Ibadan, Nigeria.

[**]Livestock Improvement Programme, Institute of Agricultural Research and Training, Obafemi Awolowo University, Moor Plantation, P.M.B. 5029, Ibadan, Nigeria.

**Abstract* *Corresponding author*: owosibo@yahoo.com

*Means of reducing the rising cost of feed resources in livestock production is a concern in the poultry industry in Nigeria.The study was carried out to investigate the effect of graded level of roselle (Hibiscus sabdariffa) seed meal on performance traits, physical and sensory quality of broiler chicken meat. One hundred and twenty birds at day 28 were used and thirty birds were randomly allotted into respective four dietary treatments [T1 - control diet with 0% inclusion level of raw roselle seed meal (RSM) while T2, T3 and T4 had 25%, 50% and 75% inclusion level of RSM respectively] in a complete randomized design. Each treatment had three replicates with ten birds per replicate. At the end of the 28-day feeding trial being 8 weeks, 24 birds (2-birds/replicate) were slaughtered for physical and sensory meat quality characteristics: colour, appearance, flavor, texture, taste and overall acceptability. Result showed there was not significant (P>0.05) difference for final weight, weight gain and feed intake among T1, T2 and T3 but T4 had significant (P<0.05) least values in final weight (1.58kg) weight gain (1.05kg) and feed intake (3.52kg) among the treatments. The FCR was not significantly different for T1 (3.32) and T4 (3.36) while both T1 and T4 differed significantly from T2 (3.13) and T3 (3.11). There were not significant (p>0.05) differences in the carcass traits that were measured across the treatments. The cooking loss from the thigh meat in T2 (27.55%) was significantly lower in comparison to treatments T3 (36.60%) and T4 (35.62%) but was not significantly different from T1 (30.48%). The cooking loss from breast and drumstick meat showed insignificant (P<0.05) difference among the treatments. The texture of the meat had least scored value in T1 (4.93) which was significantly different from T1 (6.33) but not significantly different from T2 (5.13) and T4 (6.07). The overall acceptability of the meat from the treatments was highest in T1 (7.03) with no significantly different from T3 (6.33) and T4 (6.67) but was significantly different from T2 (5.6). It can be concluded that raw roselle seed meal can be used as a substitute for full fat soybean for use in finisher broiler diets up to 50% inclusion level without adverse effect on the performance traits and some meat quality attributes of chicken.*

**Keywords:** Broilers' performance, meat quality traits and roselle seed meal.

## Introduction

The need for replacement of conventional feed ingredient is paramount on the minds of animal nutrition experts and the livestock industryfor over a decade (Onyimonyi and Okeke, 2005). This is so because feed accounts up to 60-80% of the total cost of production in intensive poultry production (Tewe, 1997). Also the rising cost of feed resources in livestock production has been established as a serious impediment to meeting the demand for animal protein particularly in developing countries (Adejinmi *et al.*, 2000). Means of reducing

the rising cost of feed resources in livestock production should therefore be a major concern to poultry farmers.

This challenge has resulted in research focus that could reduce the cost of feeding without negatively influencing the performance traits and meat quality traits of the birds. The demand and cost of soyabean, the major and most widely utilized protein ingredient in poultry diets have risen over the years. It has necessitated the search for alternative unconventional feedstuff in order to remedy the competition between man and animal for available conventional sources.

Roselle (*Hibiscus sabdariffa*) seed is a leguminous shrub well adapted to the Guinea and Sudan savannah vegetation's belts of Nigeria (Akanya *et al.*, 1997; Fasoyiro *et al.,* 2005). The roselle seeds from Nigeria contain about 35.90% crude protein, 10.14% ether extract, 10.09% ash and 15-17% crude fibre (Dashak and Nwanegbo 2002; Kwari *et al.*, 2011). The seed is a potential source of protein for poultry (Ismail *et al.*, 2008; Diarra *et al.*, 2011). Roselle seed meal as at the time of this study was sold in Nigeria at one-third of the cost of soya bean meal, and hence justifies investigating its use in poultry feeding. This situation makes roselle seed meal an attractive replacement for soybean meal in poultry diet taking into consideration the cost, availability and nutritional value of the roselle seed meal.

However, optimizing bioavailability of nutrient and performance of broiler should go along with securing the meat quality traits of broiler chicken which will meet need of consumers. Thus, the study was focused on evaluating the performance and some meat quality traits of broiler chicken fed varying levels of raw roselle (*Hibiscus sabdariffa*) seed meal.

## Material and methods

### *Experimental site*

The experiment was carried out at the poultry experimental unit of the Federal College of Animal Health and Production Technology, Moor Plantation, Ibadan, Nigeria.

### *Experimental birds and design*

Two hundred day old Abhor acre commercial broiler was purchased from the hatchery of Federal College of Animal Health and Production Technology, Moor Plantation, Ibadan. The experiment started when the birds were four weeks old. One hundred and twenty birds were randomly allocated into four treatments and each treatment had three replicates with ten birds per replicate. The experiment was a complete randomized design.

### *Experimental diet*

Raw Roselle seed meal was purchased from an open market at Bodija, Ibadan, Nigeria. The seed was cleansed and ground into meal before incorporating into diets of broiler chicken at 0%, 25%, 50%, and 75% inclusion levels for treatment 1, 2, 3 and 4 respectively. Diets were formulated to meet the NRC (1994) nutrient requirements for broilers (Table 1). The feeding trial lasted 28 days from when the birds were 28 days old (at 4 weeks) and when placed on the experimental diet to the termination of the experiment at 8 weeks old. During this experimental period, the birds were offered fresh feed and cool clean water *ad libitum*.

### *Housing and management*

Birds were housed in a deep litter pen house which was thoroughly cleaned with a disinfectant prior to the arrival of the chicks. The chicks where brooded for 14 days and all vaccinations and medication were carried out at the appropriate time. Chicks were given starter diet for four

**Table 1: Gross composition of experimental diet for broiler finisher fed graded levels of raw Roselle (*Hibiscus sabdariffa*) seed meal**

| | Treatments | | | |
|---|---|---|---|---|
| **Ingredients** | **T1** | **T2** | **T3** | **T4** |
| Maize | 45.00 | 45.00 | 45.00 | 45.00 |
| Wheat offal | 20.00 | 20.00 | 20.00 | 20.00 |
| Groundnut cake (GNC) | 8.00 | 8.00 | 8.00 | 8.00 |
| Full fat soya | 24.00 | 18.00 | 12.00 | 6.00 |
| Roselle seed meal | 0.00 | 6.00 | 12.00 | 18.00 |
| Fishmeal (72%) | 1.00 | 1.00 | 1.00 | 1.00 |
| Lysine | 0.10 | 0.10 | 0.10 | 0.10 |
| Methionine | 0.10 | 0.10 | 0.10 | 0.10 |
| Dicalcium Phosphate (DCP) | 1.30 | 1.30 | 1.30 | 1.30 |
| Broiler Premix | 0.25 | 0.25 | 0.25 | 0.25 |
| Salt | 0.25 | 0.25 | 0.25 | 0.25 |
| Total | 100 | 100 | 100 | 100 |
| M.E (Kcal/Kg) | 2915.90 | 2867.90 | 2819.90 | 2771.90 |
| Crude protein (%) | 20.90 | 22.74 | 20.58 | 20.42 |
| Crude fibre (%) | 6.08 | 7.84 | 14.41 | 11.70 |

T1, T2, T3 and T4 being 0% , 25%, 50% and 75% inclusion of raw Roselle seed meal respectively in replacement for full fat soya

weeks as pre-experimental diet. Body weight was recorded before offering feed on the first day and then subsequently on a weekly basis till the end of the experiment. Feed intake was measured on a weekly basis as well. Body weight gain, feed intake and feed conversion ratio were obtained by calculation.

***Meat quality traits assessments***

At the end of the experiment, two birds were selected from each of the three replicates of the four dietary treatments (making a total of 24 birds) and were slaughtered for the assessment of meat quality traits. The meat quality traits of broiler chicken assessed were classified into (i) sensory meat quality traits (ii) and physical meat quality traits.

Sensory meat quality traits of the broiler chicken meat were assessed from the cooked meat samples of the four dietary treatments by ten semi-trained panelists using a 9-point hedonic scale in order to find out differences in colour, taste, flavor, texture, appearance and overall acceptability. Physical meat quality trait of the broiler chicken meat that was assessed from cooked meat samples of the four dietary treatments was the cooking loss from the breast, thigh and drumstick meat respectively.

**Results**

The performance of broiler chicken fed graded level of roselle seed meal is shown in Table 2.The values obtained from daily feed intake showed that T5 (3.52) had significantly least value compared to T1 (4.16) and T2 (3.95). But no significant difference was observed in T3 (3.77) and T5 (3.52). Also, no significant difference was observed in T1 (4.16) and T2 (3.95).The weight gain of the birds among treatments T1 (1.24kg), T2 (1.26kg) and T3 (1.22kg) were not significantly ($p > 0.05$) different. But the birds in T4 (1.04kg) had the least value in weight gain which was significantly different from T1, T2, and T3. Feed conversion ratio (FCR) showed no significant ($p > 0.05$) difference between T1 (3.32) and T4 (3.36) same applies to T2

(3.13) and T3 (3.11). However, birds in T2 (3.13) and T3 (3.11) had a significantly ($p < 0.05$) lower FCR than T1 (3.32) and T4 (3.36).The birds in T1 (10%) and T3 (10%) had the highest mortality % which were not significantly ($p > 0.05$) different from each other but were significantly ($p < 0.05$) different from T4 (3.37%). There was no significant ($p > 0.05$) difference observed between T2 (6.67%) and T4 (3.37%) in mortality percent.

**Table 2: Performance Characteristics of broiler fed graded level of raw Roselle seed meal**

| | Treatments | | | | |
|---|---|---|---|---|---|
| **Parameter** | **T1** | **T2** | **T3** | **T4** | **SEM** |
| Initial weight (Kg) | 0.54 | 0.53 | 0.53 | 0.54 | |
| Final weight (Kg) | 1.78$^{a}$ | 1.79$^{a}$ | 1.75$^{a}$ | 1.58$^{b}$ | 0.04 |
| Weight gain (Kg) | 1.25$^{a}$ | 1.26$^{a}$ | 1.22$^{a}$ | 1.05$^{b}$ | 0.01 |
| Feed Intake (Kg) | 4.16$^{a}$ | 3.95$^{a}$ | 3.77$^{ab}$ | 3.52$^{b}$ | 0.31 |
| FCR | 3.32$^{a}$ | 3.13$^{b}$ | 3.11$^{b}$ | 3.36$^{a}$ | 0.22 |
| Mortality (%) | 10.00$^{a}$ | 6.67$^{ab}$ | 10.00$^{a}$ | 3.37$^{b}$ | 3.15 |

$^{a, b, c}$Means along the same row with different superscript are significantly different ($p<0.05$). T1, T2, T3 and T4 being 0% , 25%, 50% and 75% inclusion of raw Roselle seed meal respectively in replacement for full fat soya

***Carcass characteristics***

There was no significant ($p>0.05$) difference among the dietary treatments in all the carcass traits considered in this study as shown in Table 3. Also, there was no significant ($p > 0.05$) difference in the live weight of birds at slaughter among T1 (2188.50), T2 (1842.33) and T3 (1852.33). However, T4 (1683.00) had the least live weight which was significantly ($p < 0.05$) different from only from T1 (2188.50).

Sensory meat quality traits: There was no significant ($p>0.05$) difference among the dietary treatments for colour, taste, appearance and flavor (Table 4). However, there were significant ($p<0.05$) difference among the dietary treatments for texture and the overall acceptability. There was no significant difference in texture of the meat samples in T1 (6.33), T2 (5.13) and T4 (6.07). The texture of the meat samples in T3 (4.93) was significantly ($p<0.05$) more tender than the T1 (6.33). The overall acceptability of the meat samples was significantly ($p>0.05$) higher in T1 (7.03) than in T2 (5.6) but it was not significantly different from T3 (6.33) and T4 (6.67).

Cooking loss of the chicken meat: The cooking loss of the meat samples in T2 (27.55) had the least significant ($p<0.05$) difference among T3 (36.60) and T4 (35.62). But the cooking loss in T2 (27.55) was not significantly ($p<0.05$) different from T1 (30.48) as shown in Table 5.

**Discussion**

There was a gradual decrease in weight gain as the inclusion of raw roselle seed in feed increased. This significant decrease in weight gain could be attributed to the effects of raw roselle seed (Wang et al., 1999). It could also be due to the fact that roselle seed has a lot of anti-nutritional factor such as phytate, tannins, saponins, trypsin and hydrogen cyanide (Ologundudu and Obi, 2005; Abu-Tarboush and Ahmed 1997) which aided decrease in feed consumption as the concentration of raw roselle seed meal progressively increase (El-Adawy and Khalil, 1994).

**Table 3: Carcass characteristics of broiler chicken fed graded levels of raw Roselle**

| | Treatments | | | | |
|---|---|---|---|---|---|
| **Parameters** | **T1** | **T2** | **T3** | **T4** | **SEM** |
| Live weight (g) | 2188.50[a] | 1842.33[ab] | 1852.33[ab] | 1683.00[b] | 67.47 |
| Dressing weight (%) | 93.27 | 93.11 | 92.79 | 92.40 | 0.2 |
| Eviscerated weight (%) | 78.94 | 78.32 | 76.20 | 76.63 | 0.56 |
| Head (%) | 2.55 | 2.66 | 2.92 | 2.67 | 0.08 |
| Neck (%) | 5.25 | 4.99 | 4.77 | 5.15 | 0.08 |
| Breast (%) | 19.42 | 20.13 | 17.40 | 15.95 | 0.80 |
| Thigh (%) | 11.13 | 11.62 | 11.18 | 11.69 | 0.16 |
| Drumstick k (%) | 11.68 | 11.27 | 11.55 | 11.18 | 0.14 |
| Back (%) | 15.15 | 13.62 | 14.88 | 13.88 | 0.28 |
| Shank (%) | 4.32 | 4.44 | 4.58 | 4.67 | 0.15 |
| Abdominal fat (%) | 1.88 | 1.90 | 1.99 | 1.67 | 0.08 |
| Gizzard (%) | 1.98 | 2.15 | 1.83 | 2.09 | 0.09 |
| Liver (%) | 1.70 | 1.78 | 1.77 | 1.57 | 0.04 |
| Spleen (%) | 0.09 | 0.09 | 0.10 | 0.08 | 0.01 |
| Heart (%) | 0.45 | 0.41 | 0.47 | 0.42 | 0.01 |

[a, b, c]Means along the same row with different superscript are significantly different ($p<0.05$). T1, T2, T3 and T4 being 0% , 25%, 50% and 75% inclusion of raw Roselle seed meal respectively in replacement for full fat soya

**Table 4: Sensory quality of broiler chicken fed raw roselle seed meal**

| | Treatments | | | | |
|---|---|---|---|---|---|
| Parameters | T1 | T2 | T3 | T4 | SEM |
| Colour | 6.27 | 4.67 | 5.8 | 6.03 | 0.30 |
| Appearance | 6.43 | 4.93 | 5.33 | 5.70 | 0.27 |
| Flavour | 5.53 | 5.13 | 5.33 | 5.83 | 0.25 |
| Texture | 6.33[a] | 5.13[ab] | 4.93[b] | 6.07[ab] | 0.25 |
| Taste | 5.03 | 4.23 | 4.47 | 5.17 | 0.21 |
| Overall acceptability | 7.03[a] | 5.60[b] | 6.33[ab] | 6.67[ab] | 0.24 |

[a, b, c] Means along the same row with different sup erscript are significantly different ($p<0.05$). T1, T2, T3 and T4 being 0% , 25%, 50% and 75% inclusion of raw Roselle seed meal respectively in replacement for full fat soya

**Table 5: Cooking loss evaluation of broiler chicken fed with raw roselle seed meal at varying levels**

| | **Treatments** | | | | |
|---|---|---|---|---|---|
| **Parameter (%)** | **T1** | **T2** | **T3** | **T4** | **SEM** |
| Breast meat | 25.55 | 28.00 | 28.52 | 28.98 | 1.34 |
| Thigh meat | 30.48[ab] | 27.55[b] | 36.60[a] | 35.62[a] | 1.46 |
| Drumstick meat | 30.74 | 33.53 | 36.20 | 32.44 | 1.60 |

[a, b, c] Means along the same row with different superscript are significantly different ($p<0.05$). T1, T2, T3 and T4 being 0% , 25%, 50% and 75% inclusion of raw Roselle seed meal respectively in replacement for full fat soya

The feed intake showed similarity among all the treatments even though the feed intake gradually decreased as the inclusion of raw roselle seed in feed increased progressively. The reduction in feed intake may bedue to the bitter taste resulting from the saponin content of the raw roselle seed meal (Ologundudu and Obi, 2005). This gradation which was in favour of chicken in the 0% and 25% inclusion of raw roselle seed meal could be attributed to the treatment and low inclusion of raw roselle seed meal which contains high content of vitamins and minerals that enhances appetite (Ismail *et al.,* 2008) and it may be evident by higher weight gain. The T4 and T3 that recorded lower feed intake could possibly be due to the presence of high antinutritional factors in the feed or due to the high fiber content or a latent if not an overt disease which culminated in the loss of appetite. Similar trend is observed for feed conversion ratio.

The outstandingdifference in texture of the broiler chicken meat fed the 50% raw roselle seed meal, which was more tender than the 0% raw roselle seed meal had the score value ($\approx$ 5.0) corresponding to consumers' preference of neither like nor dislike as compared to the 0% raw roselle seed meal score value (6.0) which corresponds to consumers preference of like slightly. Thus, the like slightly by consumers for broiler meat sample fed 0% raw roselle seed meal is an indication that there is a preference for less tender meat which perhaps can the attributed to preference for chewing as an hedonic culture of the Nigeria populace.

The cooking loss evaluation of broilers chicken fed with raw roselle seed meal at varying levels had no significant ($p<0.05$) difference among the treatments measured in breast meat. But it was observed that the percentage values under the treatments increased progressively as the inclusion of raw roselle seed meal increases per treatment. This marginal increase in the percentage cooking loss of the breast meat could be attributed to the effect of raw roselle seed meal. However, the drumstick cooking loss also demonstrated no significant ($p>0.05$) difference among all the treatments.

Thigh meat cooking loss showed T2 was significantly ($p< 0.05$) lower when it was compared to T1, T3 and T4. This could be attributed to the high pH level of raw roselle seed thereby agreeing with Karakaya *et al.* (2006) who reported that there is significant difference ($p<0.05$) in cooking loss of meat between species of pre-rigor stage.

## Conclusion and Recommendation

Based on this experimental result, raw roselle seed meal had no adverse effect on the performance characteristics of broiler chickens and the meat quality attributes of broiler chickens were not compromised by the use of raw roselle seed meal. It can be recommended that raw roselle seed meal can be used as feed resource in broiler diet up to 50% replacement for full fat soya in broiler diet. Further research should be conducted to compare and contrast the efficacy and the effect of processed and raw roselle seed meal on the performance characteristics and meat quality attributes of broiler chicken.

## References

**Abu-Taroush, H. M., Ahmed, S. A. B. and Al Kahtani, H. A. 1997.** Some nutritional properties of roselle (*Hibiscus sabdariffa*) seed products. *Cereal chemistry*, 74(3): 352-355.

**Adejimi, O. O., Adejinmi, J. O. and Adekola, A. O. 2000.** Replacement value of fish meal with soldier fly larvae meal in broiler diets. *Nigerian Poultry Science Journal*

(1): 52-50.

**Akanya, H. O., Oyeleke, S. B., Jigam, A. A., Lawal, F. F. 1997.** Analysis of sorrel drink (Zoborodo). *Nig. J. Biochem. Mole. Biol.* 12: 77-81.

**Dashak, D. A. and Nwanegbo, V. 2002.** "Chemical composition of the seeds and calyces of Hibiscus sabdariffa grown in Jos North Local Government Area of Plateau State," *Journal of Natural Sciences* 5: 32-34.

**Diarra, S. S., Kwari, I. D., Girgiri, Y. A., Saleh, B. and Igwebuike, J. U. 2011.** The use of Sorel (Hibiscus sabdariffa) seed as feed ingredient for poultry: A Review. *Research Opinions in Animal and Veterinary Sciences* 1(9): 573-577.

**El-Adawy, T. A. and Khalil, A. H. 1994.** Characteristic of Roselle seeds as a new source of protein and lipid. Journal of Agriculture and Food Chemistry 42: 1896- 1990.

**Fagbenro, O. A. 2005.** Soybean meal substitution with roselle (Hibiscus sabdariffa L) seed meal in dry practical diets for fingerlings of the African catfish (*Clariaspirius*). *Journal of Animal and Veterinary Advances* 4: 473-477.

**Fasoyiro, S. B., Babalola, S. O. and Owosibo, T. 2005.** Chemical composition and sensory quality of Fruit-Flavoured Roselle (*Hibiscus sabdariffa*) Drinks. *World Journal of Agricultural Sciences* 1 (2): 161-164.

**Ismail, A. E., Ikram, H. K. and Nazri, H. S. M. 2008.** Roselle (*Hibiscus sabdariffa*) Seeds.Nutritional composition, protein quality and health benefits. Food 2 (1): 1-16 in Global Science Books.

**Karakaya, H. C., Tang, Y., Gregan, P. B. and Knap, H. T. 2006.** Molecular mapping of the fasciation mutation on soy bean (*Glycine max*leguminose). *America Journal of Botany* 89: 559- 565.

**Kwari, I. D., Igwebuike, J. U., Mohammed, I. D. and Diarra, S. S. 2011.** Growth, Haematology and serum chemistry of broiler chicken fed raw or differently processed sorrel (Hibiscus sabdariffa) seed meal in a semi arid environment. *International Journal of Science and Nature,* 2(1): 35-39.

**Ologundudu, F. and Obi, F. O. 2005** Prevention of 2, 4-dinitophynylhydrazine induce tissue damage in Rabbits by orally administered decoration of dried flower of Hibiscus sabdariffa. *Journal of Medical Sciences* 5: 208-211.

**Onyimonyi, A. E. and Okeke, G. C. 2005.** "Chemical composition of the seeds and calyces of Hibiscus sabdariffa grown in Jos North local Government Area of Plateau State". *Journal of Natural Sciences* 5:32-34.

**Tewe, O. O. 1997.** Sustainability and development paradigm from Nigeria's Livestock Industry.Inagural lecture delivered on behalf of Faculty of Agriculture, University, p. 50.

**Wang, L. J., Byrem, T. M., Zarosley, J., Booren, A. M. and Strasburg, G. M. 1999.** Skeletal muscle calcium channel ryanodine binding activity in genetically unimproved and commercial turkey populations. *Poultry Science* 78: 792-797.

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