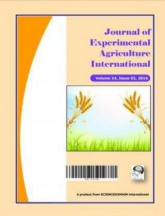

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Performance and Meat Quality Attributes of Broiler Chickens Fed Onion Skin Extract and Onion Skin Meal Supplemented Diets at the Finisher Stage

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Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aims: This study was carried out to investigate the meat quality attributes of broiler chickens fed onion skin extract and onion skin meal supplemented diets at the finisher stage.
Study Design: The experiment employed a complete randomized design; all data generated were subjected to analysis of variance, P=0.05.
Place and Duration of Study: The study was carried out at the Teaching and Research Farm of the University of Ibadan, Ibadan, Nigeria, between October and December, 2016
Methodology: Four experimental diets were formulated such that treatment 1 contained the basal diet with synthetic antioxidant, treatment 2 was a basal diet without any antioxidant, and treatment 3 was basal diet supplemented with 30g/kg of onion skin extract while treatment 4 contained basal diet supplemented with 100 g/kg of onion skin meal. One hundred and sixty eight broiler birds were randomly assigned to four treatments of six replicates each at seven birds per replicate. They were raised for 8 weeks. At the expiration of the experiment, three birds from each replicate were randomly selected, tagged, fasted, weighed and slaughtered. Carcass and organs were obtained and weighed. Samples for cooking loss, pH and cooking yield were taken. Thiobarbituric Acid Reactive Substances (TBARS) was employed to assess the shelf stability of the product.

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Results: Data obtained showed no significant difference (P≥0.05) in feed intake for all the dietary treatments. However, the feed conversion ratio was significantly higher (p≤0.05) in treatment 4 compared to others as treatment 3 recorded the best feed conversion value (3.31). Treatment 2 had the highest (P≤0.05) TBAR value. While there was no significant difference (p≥0.05) in pH of all the treatments, treatment 2 had the lowest cooking loss (25.18%) and was significantly different (p≤0.05) from other treatments.
Conclusion: This finding revealed that diets supplemented with onion skin extract had the best feed conversion ratio which resulted in higher final body weight and weight gain. Onion skin extract could prolong the shelf life of broiler meat better than onion skin meal and synthetic antioxidant.

Keywords: Antioxidant; onion skin extract; onion skin meal; cooking loss; broiler chicken.

1. INTRODUCTION

Poultry meat is more susceptible to oxidative deterioration due to a high content of polyunsaturated fatty acids (PUFA) [1] compared with meat from other species with a lower content of PUFA. Incorporation of herbs and botanicals with antioxidative properties in the broiler diet have been discovered to improve the shelf life of poultry meat by decreasing the rate of lipid oxidation [2]. Antioxidative properties of plants are attributed to compounds such as ascorbic acid, α-tocopherol, β-carotene, various flavonoids, and other phenolic compounds [3].

Antioxidant is any substance that when present at low concentration compared to those of an oxidisable substrate significantly delays or prevents oxidation of that substrate [4]. Antioxidants play a very important role in the body defense system against reactive oxygen species (ROS) or free radicals, which are harmful by-products generated during aerobic activity of normal cells. With an increase in dietary antioxidant intake, antioxidant status to maintain the normal physiological function of the living system will be maintained. Antioxidants have great importance in terms of preventing oxidative stress that may cause several generative diseases [5].

Consumers are becoming health conscious and aware of the food nutritional additives. Among the nutritional additives expected by consumers in food is an antioxidant. Antioxidants are popular due to their ability to prevent many physiological diseases or illnesses.

Among natural foods rich in antioxidant is Onion. The consumption of onion has increased due to its flavour and health benefits. These beneficial properties seem to strongly relate to the high content of sulphur compounds and flavonoids, because of their activity as antioxidants and anticarcinogens, their effects on lipid metabolism and the cardiovascular system, and their antibiotic effects [6].

A lot of researches have been done to evaluate the antioxidative properties of different plants, but there is need to work more on waste materials that are not consumable to human. Therefore, this necessitate the need to evaluate the meat quality attributes of broiler chickens fed onion skin extract and onion skin meal supplemented diets.

2. MATERIALS AND METHODS

2.1 Experimental Site

The experiment was carried out at the poultry unit of the Teaching and Research Farm, University of Ibadan for 48 days.

2.2 Extraction Procedure

Onion Bulbs were gotten from Bodija market in Ibadan, Oyo State. The skins were removed and sun-dried until constant weight was reached and milled. Three litres of 80% methanol was used to soak 90 grams of the onion skin for 24 hours. The methanol extract was then decanted and placed in a rotary evaporator to concentrate.

A total of one hundred and sixty eight broiler chickens were used for the experiment. They were equally allotted into four treatment groups of six replicates of seven birds each to make a total of forty-two birds per treatment. The experimental diets consisted of four dietary treatments; negative control diet, positive control, diet with onion skin meal and onion skin extract diet. The diets were formulated as illustrated below:

Treatment 1: Basal diet + EDTA (0.1 g/kg)
Treatment 2: Basal diet

Treatment 3: Basal diet + Onion skin extract (30 g/kg)
Treatment 4: Basal diet + Onion skin meal (100 g/kg)

2.3 Feed Intake

A known weighed quantity of feed was given to the birds and the left over was weighed and recorded on daily basis and used to determine the amount of feed consumed by the birds.

2.4 Weight Gain

Each bird was weighed on arrival to get the average weight at day old and the average initial weight was 35.98 g, after which the birds were weighed weekly per replicate. This was used to estimate the average daily weight gain.

2.5 Feed Conversion Ratio (FCR)

This is the ratio of average feed consumed to the average body weight:

FCR = Average feed consumed (kg)/ Average body weight (kg)

2.6 Carcass Evaluation

At the end of the eight weeks experimental period, 18 birds were randomly selected per treatment, tagged, weighed and slaughtered by cutting the jugular vein. The feathers were removed, eviscerated and cut into parts. Weights of the following were taken using sensitive weighing balance; Slaughter weight, Breast, Thigh, Drumstick, Back, Wings.

2.7 Internal Organs

Relative organ weights to live body weight of randomly selected birds were determined at the termination of the experiment. The weights of the following organs were determined using a sensitive weighing balance; liver, bile, spleen, heart and abdominal fat.

2.8 Physico-chemical Parameters

2.8.1 pH

Meats from each sample (10 g) were homogenized in 90 mL distilled water. The pH of homogenized samples were measured using a glass pH.

2.8.2 Analysis of oxidative rancidity

TBARS was determined by the modified methods of [7]. Five grams of sample was weighed into 50 mL test tube, homogenized with 15 mL of deionized distilled water using the polytron homogenizer for 10 sec at high speed. 1 mL of homogenized sample was transferred into a disposable test tube 13 x 100 mm butylated hydroxyanisole (50µl, 10%). Tricholoroacetic acid (TBA) 2 mL was added. The mixture was vortexed and then incubated in a boiling water bath for 15 min to develop colour. The sample was then cooled in cold water for 10 min, vortexed again and centrifuged for 15 min at 2000 x g. The absorbance of the resulting supernatant solution was determined at 531 nm against a blank containing 1mL of deionized distilled water and 2 mL of TBA/Trichoroacetic acid solution. The amount of TBARS was expressed as milligrams of malondialdehyde per kilogram of sample.

2.8.3 Percentage of cooking loss

Meat samples (50 g) were taken from the breast muscle of each carcass and boiled to an internal temperature of 72ºC. The water released after cooking and cooling was manually separated and the weight of the cooked meat was taken to obtain the cooking loss.

Percentage cooking loss was calculated as:

Weight of meat sample before cooking – weight of meat sample after cooking x100 / Weight of meat sample before cooking

2.8.4 Cooking yield

Meat samples (50 g) were taken from the breast muscle of each carcass and boiled to an internal temperature of 72ºC.

Cooking yield was calculated as:

Weight of cooked meatx100/ Weight of raw meat

2.9 Experimental Design

Complete randomized design was employed. The data collected were subjected to analysis of variance (ANOVA) using SAS v. 9.3 (2011) package where significant differences were found at 5% level of significance. The means

were compared using Duncan Multiple Range Test of the same software [8].

3. RESULTS AND DISCUSSION

3.1 Performance Characteristics of Broiler Chickens Fed Diets Supplemented with Onion Skin Extract and Onion Skin Meal at Finisher Stage

Table 2 shows the performance characteristics of broiler chickens fed diets supplemented with onion skin extract and onion skin meal. There was no significant difference ($p \geq 0.05$) in feed intake of all treatments. Feed Conversion Ratio revealed that treatment 4 was significantly higher than other treatments; although treatments 2 and 3 were statistically similar ($p \geq 0.05$), but T3 had the lower value (3.31).

There was significant difference ($p \leq 0.05$) in the final body weight and weight gain of the dietary treatments as the diet containing onion skin extract had the highest increase in weight with 2.07kg and 1.50kg weight gain. The significantly higher weight gain ($p \leq 0.05$) revealed by chicken fed diet supplemented with onion skin extract might be due to additional flavour from onion skin extract which improves feed palatability thereby increase weight gain. Control and synthetic antioxidant supplementation were not significantly different. Although, there was no statistical evidence in the feed intake of all treatments but birds fed onion skin extract and onion skin meal consumed more. It has been documented that the use of onion extract in drink water resulted in increased feed intake and onion in diet can reduce the blood glucose (hypoglycemia) which can stimulate nervous system for higher feed intake [9]. The herbs and some compounds in onion could act similar to antibiotics. These compounds reduced the growth of some harmful bacteria in the gastrointestinal tract of broilers; this can result in a higher efficiency in the feed utilization, and it can lead to a higher weight gain and better feed efficiency [10].

3.2 Effect of Dietary Supplementation of Onion Skin Extract and Onion Skin Meal on Primal cut of Broiler Chickens at Finisher Stage

The effect of dietary supplementation of onion skin extract and onion skin meal on primal cuts of broiler chickens is shown in Table 3. Diet with synthetic antioxidant revealed significant high value (15.75%) of back weight compared with the control and diets supplemented with onion skin meal and extract. Breast muscle, drumstick, wings, and thigh were not affected by supplementation of onion skin meal and onion skin extract in broiler diet ($P \geq 0.05$). However, diet with synthetic antioxidant had higher back weight compare with treatments 1, 3 and 4. The dietary supplementations of onion skin and onion skin meal on back were not different from each other but differ from other treatments. The findings suggest that supplementation of onion skin extract and meal may influence the primal cut of broiler chicken. This result contradict the outcome of [11] that reported no significant difference in primal cut of broiler fed supplemented natural antioxidant.

Table 1. Gross composition of experimental diet (%)

Ingredients	Starter	Finisher
Maize	57.00	60.00
Soybean meal	32.00	29.00
Fish meal	2.50	0.00
Wheat offal	5.50	7.00
DCP	2.00	2.00
Salt	0.25	0.25
DL-Methionine	0.20	0.20
L-Lysine	0.05	0.05
Broiler premix	0.25	0.25
Mycofix	0.25	0.25
Total	100.00	100.00

3.3 Effect of Dietary Supplementation of Onion Skin Extract and Onion Skin Meal on Organ Weight of Broiler Chickens at Finisher Stage

Table 3 shows the effect of dietary supplementation of onion skin extract and onion skin meal on organ weight which reveals that there were no significant differences ($p \geq 0.05$) in spleen, liver and abdominal fat. Onion skin meal significantly increases weight of the heart (0.53%) of broiler chicken compared with treatment on control and synthetic antioxidant. Treatment 2 and 3 were not significantly different from each other ($p \geq 0.05$). The mean value of treatment 2 revealed significant higher values of bile (0.16%) compared with treatments 1, 3 and 4. While there was no significant difference ($p \geq 0.05$) in abdominal fat values for all the treatments, treatment 2 had the highest value (1.35%) while treatment 4 had the lowest (1.06%).

The effect of dietary supplementation of onion skin extract and onion skin meal in broiler diet did not affect spleen, liver and abdominal fat. Diets with onion skin extract and onion skin meal had a significant lower abdominal fat weight compared to the synthetic antioxidant dietary and the positive control diet. Abdominal fat and relative organs weight were not markedly affected by dietary treatments. These results are in agreement with those reported by [12] and [9]. In another experiment, carcass and organ characteristics of broilers fed diets containing garlic were not affected by experimental treatments [13]. Spices and their extracts have lipotropic effects thereby causes some of the active components in spices to affect lipid metabolism through fatty acid transportation. This can increase the lipid utilization and decrease abdominal fat [14].

3.4 Effect of Dietary Supplementation of Onion Skin Meal and Onion Meal on Physicochemical Properties of Broiler Chickens at Finisher Stage

In Table 4, physicochemical properties of broiler chicken, like TBARS, was greatly affected by diet supplementation with onion skin extract and onion skin meal. Thiobarbituric acid reactive substance revealed that synthetic antioxidant had higher mean value (1.02 mg MA/g) compared with other treatments. pH of treatments was not significantly affected (p≥0.05) by onion skin meal and extract. The cooking loss showed that there were no significant differences (p≥0.05) in the dietary treatments except treatment 2 which had the lowest value (25.18%). There was no significant difference in cooking yield of treatment 1 and 3; however, treatment 2 was significantly (p≤0.05) higher (74.82%) than others while treatment 4 had the lowest (65.28%).

Physicochemical properties of broiler chicken indicate a significant difference in TBARS (P≥0.05). The meat of broiler chicken fed supplemented onion skin meal and extract reduced significantly compared to chicken with synthetic antioxidant. This result is in agreement with [15] who reported that aromatic and medicinal herbs are rich sources of natural radical scavenging compounds like industrially used antioxidant, which inhibit the oxidative chain reaction by inactivating free radicals formed during peroxidation of lipids. However, pH of broiler meat is not affected by supplementation of antioxidant. This might be due to the fact that pH of meat is usually influenced by pre- slaughter stress of animal and post slaughter management of the meat and pH of meat might have reflected different glycogen reserves pre- slaughter [16]. Cooking loss revealed that chicken with synthetic

Table 2. Performance characteristics of broiler chickens fed diets supplemented with onion skin extract and onion skin meal at finisher stage

Parameters	Treatments				SEM
	T1	T2	T3	T4	
Initial weight (Kg)	0.58	0.59	0.57	0.57	
Final body weight (kg)	1.92^{ab}	1.98^{ab}	2.07^{a}	1.84^{b}	0.04
Weight gain (kg)	1.34^{ab}	1.39^{ab}	1.50^{a}	1.27^{b}	0.04
Feed intake (kg)	4.94	4.92	4.97	5.06	0.06
FCR	3.69^{b}	3.54^{c}	3.31^{c}	3.98^{a}	0.07

$^{a, b, c, d}$ *Means with different superscript along the row are significantly different (P≤0.05)*
FCR: Feed conversion ratio, SEM: Standard error of mean
T1=Negative control, T2 =Positive control, T3=30% Onion skin extract, T4=Onion skin meal

Table 3. Effect of dietary supplementation of onion skin extract and onion skin meal on Primal cut of broiler chickens at finisher stage

Parameters (%)	Treatments				SEM
	T1	T2	T3	T4	
Breast muscle	16.87	17.52	18.48	17.04	0.30
Drumstick	10.80	11.12	10.99	11.08	0.13
Wings	8.38	8.59	8.75	9.50	0.23
Back	14.07^{ab}	15.75^{a}	13.29^{b}	13.07^{b}	0.41
Thigh	10.40	10.57	11.00	10.62	0.16

$^{a, b, c, d}$ *Means with different superscript along the row are significantly different (P≤0.05)*
T1=Negative control, T2 =Positive control, T3=30% Onion skin extract, T4=Onion skin meal

Table 4. Effect of dietary supplementation of onion skin extract and onion skin meal on organ weight of broiler chickens at finisher stage

Parameters (%)	Treatments				SEM
	T1	T2	T3	T4	
Heart	0.45[b]	0.50[ab]	0.48[ab]	0.53[a]	0.12
Spleen	0.16	0.13	0.15	0.11	0.44
Liver	1.94	2.04	1.94	1.90	0.23
Bile	0.14[ab]	0.16[a]	0.09[c]	0.13[ab]	0.51
Abdominal fat	1.31	1.35	1.12	1.06	0.11

[a, b, c, d] *Means with different superscript along the row are significantly different (P≤0.05)*
T1=Negative control, T2 =Positive control, T3=30% Onion skin extract, T4=Onion skin meal

Table 5. Effect of dietary supplementation of onion skin extract and onion skin meal on physicochemical properties of broiler chickens at finisher stage

Parameters	Treatments				SEM
	T1	T2	T3	T4	
TBARS(mgMA/g)	0.86[ab]	1.02[a]	0.24[c]	0.63[b]	0.39
pH	6.37	6.45	6.48	6.54	0.37
Cooking loss (%)	29.36[a]	25.18[b]	28.98[a]	30.69[a]	0.73
Cooking yield (%)	70.56[b]	74.82[a]	70.87[b]	65.28[c]	0.95

[a, b, c, d] *Means with different superscript along the row are significantly different (P≤0.05)*
T1=Negative control, T2 =Positive control, T3=30% Onion skin extract, T4=Onion skin meal

antioxidant is significantly lower than control and meat of chicken fed onion skin meal and onion skin extract. This might be due to the potential of synthetic antioxidant to reduce lipid content compare to natural antioxidant. Also, lower quantity of natural antioxidant in feed can also increase cooking loss. This is contrary to the report of [11] and [17] who reported no significant differences in meat of broiler supplemented plant extract.

4. CONCLUSION

Results from this study demonstrate that chicken meat from broilers fed onion skin extract and onion skin meal –supplemented diets had lower fat content compared with broilers fed a control diet and a synthetic anti-oxidant. The results of the study have also shown that meat from broilers fed onion skin extract and onion skin meal supplemented diets gave optimum performance in terms of feed conversion ratio and weight gain.

5. RECOMMENDATION

It could, therefore, be recommended that supplementing broiler chicken diets with natural anti-oxidants such as onion skin extract and or onion skin meal can produce chicken meat with favorable lipid profiles and good performance characteristics in terms of weight gain.

ETHICAL APPROVAL

As per international standard or university standard, ethical approval has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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