Performance and sensory properties of broilers fed finisher diet supplemented with onion skin extract

Tella, A. K[1]., Olubunmi, O. O[2]., Bello, O. M[2].
[1]*Department of Animal Production, College of Animal Science, Joseph Sarwuan Tarka University, Makurdi.*
[2]*Department of Animal Science, University of Ibadan, Ibada*n.
Corresponding author: tellakehinde96@gmail.com, +23408062222538

Abstract

Allium species contain phenolic compounds that have been proven, by the inclusion in animal feed or directly on meat, to influence organoleptic attributes of meat and meat products. Hence, the effect of dietary supplementation of Onion Skin Extract (OSE) on performance and sensory properties of broiler chickens were investigated at the finisher phase. In a 4-week trial with Marshal broiler chicks (n=168), birds were allotted to four treatments, each replicated six times with seven birds per replicate in a completely randomized design. Birds were fed basal diet as the control, while diet 2, 3 and 4 contained 100, 200 and 300mg/kg of feed respectively. Increased OSE in broiler finisher diet improved (P < 0.05) feed to weight gain. Supplementation of diet with OSE in broiler diet did not affect the primal cuts (P > 0.05). Birds on 100mg/kg of OSE had higher weight gain (P < 0.05) than other treatments. Apart from gall bladder, abdominal fat, heart, liver and spleen were not different (P > 0.05). Increased OSE improved (P < 0.05) performance of chicken, flavour, aroma, tenderness and overall acceptability of broiler meat.

Keywords: Onion skin extract, Antioxidants, Growth performance, broilers, primal cut

Performances Et Propriétés Sensorielles Des Poulets De Chair Nourris Au Régime Finisseur Complété En Extrait De Peau D'oignon

Résumé

Les espèces d'Allium contiennent des composés phénoliques dont il a été prouvé, par leur inclusion dans les aliments pour animaux ou directement sur la viande, qu'ils influencent les attributs organoleptiques de la viande et des produits à base de viande. Par conséquent, l'effet de la supplémentation alimentaire en extrait de peau d'oignon (EPO) sur les performances et les propriétés sensorielles des poulets de chair a été étudié lors de la phase de finition. Dans un essai de 4 semaines avec des poussins à griller Marshal (n = 168), les oiseaux ont été répartis dans quatre traitements, chacun répété six fois avec sept oiseaux par répétition dans une conception entièrement randomisée. Les oiseaux ont reçu un régime de base comme témoin, tandis que les régimes 2, 3 et 4 contenaient respectivement 100, 200 et 300 mg/kg de nourriture. L'augmentation de l'EPO dans le régime de finition des poulets de chair a amélioré (P < 0,05) l'alimentation par rapport au gain de poids. La supplémentation de l'alimentation en EPO dans l'alimentation des poulets de chair n'a pas affecté les coupes primaires (P > 0,05). Les oiseaux recevant 100 mg/kg d'EPO avaient un gain de poids plus élevé (P < 0,05) que les autres traitements. En dehors de la vésicule biliaire, la graisse abdominale, le cœur, le foie et la rate n'étaient pas différents (P > 0,05). L'augmentation de l'EPO a amélioré (P < 0,05) la performance du poulet, la saveur, l'arôme, la tendreté et l'acceptabilité globale de la viande de poulet.

Mots-clés : Extrait de peau d'oignon, Antioxydants, Performances de croissance, poulets de chair, coupe primaire

Introduction

Meat consumer acceptability has been greatly affected by oxidative deterioration of meat caused primarily by lipid peroxidation resulting in undesirable rancid off-flavour and colour deterioration that limits meat shelf life (Lorenzo and Gomez, 2012). The presence of antioxidants has been reported to limit lipid oxidation in meat and meat products. However, the synthetic antioxidants mostly used by meat industries have been exposed to criticism because of its association with numerous vascular diseases in human. (Shahidi and Zhong, 2010). Therefore, researchers need to consider potential natural alternatives to synthetic antioxidants (Brewer, 2011) with flavonoids naturally found in plants like onion being a target.

It is difficult to ensure that the additive is uniformly dispersed throughout the product, as it avoids unintended organoleptic effects (Cavalheiro *et al*., 2015). One potential alternative is to apply the antioxidant to the diet of the animal instead of the end product, thereby utilizing the physiological processes of the animal to improve the antioxidant status of the muscle (Decker and Park, 2010; Falowo *et al*., 2014). The flavonoid compounds could have sparing effect on other antioxidants or by direct deposition in the tissues (Valenti *et al*., 2018).

Onion skin has been documented as one of the kitchen waste rich in flavonoids. In Nigeria, large amount of onion wastes are generated by producers of onion both domestically and industrially get decayed by adding themselves to the soil. The waste generated from onion comprise onion skins, two outer fleshy scales and roots generated during industrial peeling and undersized malformed or damaged bulbs (Benitez *et al.,* 2011). These wastes generate an environmental problem since onion wastes are not suitable for fodder in high concentration due to its characteristic aroma, neither could it be used as inorganic fertilizer because of the rapid development of phytogenetic agents (Waldron, 2001). Hence, there is a need to find other uses of onion wastes. Several works had been done on onion wastes to gain knowledge of their dietary fibre component, antibiotic properties, sulphur content and phenolic content (Benitez *et al.,* 2011; Goodarzi *et al*., 2013; Goodarzi *et al*., 2014).Reports on the antioxidative properties of onion skin and its effect on sensory properties are however scanty. Therefore, the growth performance and sensory of broilers fed finisher diet supplemented with onion skin extract was examined.

Materials and methods

Extraction Procedure

Onion skins were obtained from the market, sun-dried until constant weight was reached and milled. Thirty grams per litre of Onion skin was soaked in 80% methanol for 24 hours. The methanol extract was filtered through 0.2µm and solvent (methanol) was removed by rotary evaporation (Labo-Rota C-311, Resona Technics, Switzerland) for 1h at 55 ºC and stored in the refrigerator at 4 ºC.

Animal and experimental design

A total of 168 1-day old Marshal vent sexed male broiler chicks were procured from commercial hatchery. The chicks were raised on commercial broiler starter diet for 4 weeks. They were weighed and randomly assigned after 4 weeks to four experimental diets viz; Basal Diet (Control), Diet 2, 3 and 4 contained 100, 200 and 300mg of Onion Skin Extract (OSE) per kilogram of feed, respectively. Experimental treatments contained 42 birds, 6 Replicates per treatment and 7 birds per replicate. Feed and water were given *ad-libitum*. The formulated control finisher diets contain approximately 20% crude protein, 4% crude fibre 3100ME kcal/kg. At the end of the experiment (4 weeks), broilers were weighed to calculate feed efficiency. After birds were fasted for 12 hours, two birds were randomly selected per replicate, tagged, weighed and slaughtered by cutting the jugular vein. The birds were defeathered under warm carcass condition and eviscerated.

Sensory evaluation

A total of 40 respondents aged between 20 and 40 years were used to assess meat samples from the two replicates. The samples were evaluated using a 9-point hedonic scale for flavour, colour, juiciness, tenderness, and overall acceptability according to Cross *et al.,* (1978). The scale had a maximum score of 9, while the lowest score of 1 was assigned to the poorest condition (Mahendraker *et al.,* 1988). Each sample was evaluated independent of the other. The samples of chicken breast part were cooked to attain

internal temperature of 72 ºC for 20 min. The samples were coded with 3 numeric digits and randomized, then were presented to consumers at a temperature of 60° C in disposable plastic trays and served with water to be ingested between evaluations (Meilgaard *et al*., 1999).

Experimental Design

Completely randomized design was employed. The data collected were subjected to analysis of variance (ANOVA) using SAS v. 9.3 (2011) package and means were compared using the same software's Duncan Multiple Range Test.

Results and discussion

Broiler performance

Daily feed intake of broilers fed supplemented OSE ranged from 102.92g to 105.42g per bird and was not significantly affected (P > 0.05). This result agreed with An *et al.* (2015) and Farahani *et al.* (2015) who reported no significant different in broiler chicken feed intake using aqueous onion extract in drinking water. This might be due to addition of OSE as an additive which has little effect on the nutrient composition of the diet.

Table 1: Performance of broiler chickens fed diets supplemented with onion skin extract

	Inclusion level of onion skin extract (mg/kg)					
Parameters	0	100	200	300	SEM	p-value
Daily Feed intake/bird (g)	102.50	103.54	105.42	104.79	0.06	0.542
Daily Weight gain/bird (g)	28.95^{ab}	31.25^{a}	26.45^{b}	26.92^{b}	0.04	0.021
Feed/weight gain	3.54^{c}	3.31^{c}	3.98^{a}	3.90^{a}	0.07	0.022
Primal cuts (%)						
Breast muscle	17.52	17.55	17.04	18.48	0.27	0.432
Drumstick	11.12	11.30	10.57	11.00	0.13	0.323
Thigh	10.57	10.55	10.72	11.00	0.15	0.231

^{abc} Means with different superscripts within a row vary significantly (P< 0.05); SEM: Standard Error Mean;

Daily weight gain of broiler fed supplemented OSE ranged from 26.45g to 31.25g per bird. Broiler weight gain seems to be affected (P < 0.05) by dosage of OSE in feed. Treatment with lower inclusion of OSE (100mg/kg) was significantly higher while the lowest weight gain was recorded in 200mg OSE/kg of feed supplementation. The result of this study agreed with Farahani *et al.* (2015) who reported an increase in weight gain when aqueous onion extract was added to Cobb and Ross broiler strain diets. According to Goodarzi *et al.* (2013), onion stimulated growth of an animal by increasing the inflow of glucose into tissues. However, continuous increase in OSE supplementation significantly reduced (p<0.05) the weight gain. This might be due to higher content of phenolic compound in other treatments. According to Salami *et al*. (2019), high content of dietary phenolic compounds lower the feed palatability in animal which may reduce birds' weight gain.

The feed to weight gain of broilers fed supplemented OSE ranged from 3.31 – 3.98. The result from this study was higher than the report of Goodarzi *et al*. (2014) who reported ranges from 1.99 to 2.03 at finisher stage. Breed, environmental condition, feed and management are factors that could influence the changes. The lowest inclusion level of OSE (100mg/kg) and control reflected the lowest feed to weight gain while 200 and 300/kg OSE supplementation were significantly higher than other treatments. This might be due to higher weight gain of broiler fed supplemented 100mg OSE/kg of feed compared to 200 and 300 mg/kg supplementation. Similar to this result, Goodarzi *et al*. (2013) reported the positive influence in feed to weight gain of broilers fed diets containing fresh onion compared with broilers fed diet without any onion and antibiotics. Onion skin extract has an antimicrobial and inhibitory effect on pathogenic microorganism development, thereby raising the number of beneficial microorganisms, increasing

digestive secretions that provide better digestive efficiency for food intake, ultimately improving the feed conversion ratio (Kumar *et al.,* 2010).

Visceral and abdominal fat

Heart, spleen, Liver and abdominal fat were not affected by inclusion of OSE in broiler diets (table 2). This result was in consistent with An *et al.* (2015) who found no significant different when onion extracts was used to evaluate growth performance, carcass characteristics and blood profiles of white mini broilers. Abdominal fat ranged between 1.12 to 1.46% compared with 1.95 to 2.46% reported by Goodarzi *et al*., (2014) who also reported that onion extract inclusion in broiler drinking water significantly affected the abdominal fat contrary to the result of this research. This could be as result of differences in breed used and extraction method.

Table 2: Effect of dietary supplementation of onion skin extract on visceral and abdominal fat of broiler chickens

	Inclusion level of onion skin extract (mg/kg) feed					
Parameters (%)	0	100	200	300	SEM	P-value
Heart	0.50	0.45	0.53	0.48	0.13	0.232
Spleen	0.13	0.15	0.17	0.15	0.09	0.120
Liver	2.04	1.97	2.09	1.94	0.32	0.143
Gall bladder	0.16^{a}	0.15^{ab}	0.13^{ab}	0.09^{c}	0.09	0.032
Abdominal fat	1.35	1.46	1.45	1.12	0.11	0.165

^{abc} Means within a row with different superscripts differs significantly ($P < 0.05$); SEM: Standard Error Mean;

However, gall bladder was affected significantly by the inclusion of OSE in broiler feed. The control was significantly higher ($P < 0.05$) than other treatments with OSE supplementation. Hepatic synthesis of bile acids accounts for the majority of cholesterol breakdown in the body. The higher the cholesterol in the body, the higher the bile converted and this might be the reason for the higher weight of gall bladder of broiler fed control diet.

Sensory analysis

The effects of dietary antioxidant on sensory attributes seem to depend on the dose administered to the feed. Some of the factors affecting the impact of natural antioxidants on broiler meat are inclusion level, environmental conditions, basal diet and potential associations with the condition of rearing and/or dietary materials (Kirkpinar *et al.,* 2014). Among the sensory trait measured, only colour of the meat was not significant ($P > 0.05$). This could be due to addition of OSE as an additive which may have little effect on the colour of the meat. Also, colour measured in this case was subjective which may not be precise compared with the use of colorimeter. Similar result was reported by Symeon *et al*. (2009) who reported that two concentrations of oregano essential oil (100 or 250 mg/kg) in the feed did not change L* and a* of medium-growing female broilers at 9 weeks of age. Colour changes in meat could hardly be seen by naked eyes since numerical changes in colour attributes are minor. Meat from broiler chicken fed diet supplemented with 300mg OSE /kg had significant higher mean value of aroma (7.30) and flavour (8.76) followed by those fed 200mg OSE/kg. This implies that the higher the quantity of OSE in broiler feed, the higher the aroma and flavour in the meat. This might be due to higher content of sulphuric compound in onions which improve the aroma and flavour of meat.

The juiciness of meat is one of the fundamental meat traits, and it enhances meat texture which depends on the quality and composition of fat (Muchenje *et al*., 2010). The juiciness in this study was significantly influenced by dietary treatments. The observation in this study agreed with Mareko *et al.* (2010) who reported a significant effect on the juiciness of drumstick meat of broilers fed *L. belina* meal at 40% inclusion levels.

Tenderness is one of the significant characteristics of meat quality determined by variables such as strain, diet, sex, age, and the environment. Tenderness is also a valuable

Table 3: Sensory properties of meat from broiler chickens fed graded level of onion skin extract

	Inclusion level of onion skin extract (mg/kg)					
Indices	0	100	200	300	SEM	p-value
Aroma	3.14[c]	3.26[c]	5.10[b]	7.30[a]	0.25	0.024
Flavour	3.15[d]	4.43[c]	7.89[b]	8.76[a]	0.14	0.028
Colour	6.14	5.98	6.12	6.45	0.24	0.458
Tenderness	4.67[c]	4.32[c]	6.89[b]	8.67[a]	0.13	0.029
Texture	4.56	4.34	5.25	5.38	0.17	0.312
Juiciness	5.24[b]	6.35[ab]	7.68[a]	7.89[a]	0.11	0.032
Overall acceptability	5.67[b]	5.34[b]	7.54[a]	7.57[a]	0.14	0.034

[abc] Means within a row with different superscripts differs significantly ($P < 0.05$);Basal diet; T2 – Basal diet +100mg OSE/kg of feed; T3 – Basal diet + 200mg OSE/kg of feed; T4 – Basal Diet + 300mg OSE/kg of feed

sensory characteristic that can be measured by skilled people (sensory) and physical techniques (Li *et al*., 2013). In this study, tenderness of breast meat was influenced ($P < 0.05$) by dietary treatments. The findings were in agreement with Borgogno *et al*. (2017) and Radulovic *et al*. (2018) who reported a significant difference in the tenderness of breast meat from broiler chickens fed *M. domestica* and *H. illucens*. The sensory analysis of breast meat samples showed higher acceptability from broilers fed 300mg/kg of OSE.

Conclusion

The present study demonstrated that supplementation of 100mg/kg of onion skin extract in broiler diets improve broiler feed conversion.Increased in onion skin extract in finisher broiler diet improve overall acceptability of broiler meat.

References

An, B. K., Kim, J. Y., Oh, S. T., Kang, C. W., Cho, S. and Kim, S. K. 2015. Effects of onion extracts on growth performance, carcass characteristics and blood profiles of white mini broilers. *Asian-Australian Journal of Animal Science*. 28, 247–251.

Benítez, V., Mollá, E., Martin-cabrejas, M., Aguilera, Y., López-andréu, F., Cools, K., Terry, L. and Esteban, R. 2011. Characterization of industrial onion wastes (Allium cepa L.): Dietary fi bre and bioactive compounds. *Plant Food. Hum. Nutr*., 66, 48–57.

Borgogno, M., Dinnella, C., Iaconisi, V., Fusi, R., Scarpaleggia, C., Schiavone, A., Monteleone, E., Gasco, L. and Parisi, G. 2017. Inclusion of Hermetiaillucens larvae meal on rainbow trout (Oncorhynchusmykiss) feed: effect on sensory profile according to static and dynamic evaluations. *Journal of Science, Food and Agriculture*. 97(10):3402–3411.

Brewer, M. S. 2011. Natural antioxidants: Sources, compounds, mechanisms of action, and potential applications. *Comprehensive Reviews in Food Science andFood Safety*, 10, 221–247.

Cavalheiro, C. P., Ruiz-Capillas, C., Herrero, A. M., Jimenes-Colmenro, F. Menezes, C. R. and Fries, L. L. M. 2015. Applicaton of Probiotic Systems in Meat Products. *Trends in Food Science and Technology*, 46: 120-131.

Cross, H. R., Moen, R., and Stanfield, M., 1978, "Guide lines for training and testing judges for sensory analysis of meat quality", *Food Technology*, 32:48-53.

Decker, E. A., and Park, Y. 2010. Healthier meat products as functional foods.*Meat Science*, 86, 49–55.

Falowo, A. B., Fayemi, P. O. and Muchenje, V. 2014. Natural antioxidants againstlipid protein oxidative deterioration in meat and meat products: *A review. Food Research International*, 64, 171–181.

Farahani, M., Goodarzi, M. and Nanekarani, S. 2015. The effects of aqueous extract of onion on performance and some blood biochemical parameters of the Cobb and Ross broilers. *International Journal of*

Advance Biology and Biomedical Research. 3, 370–377.

Goodarzi, M., Landy, N. and Nanekaran, S., 2013. Effect of onion (Allium cepa L.) as an antibiotic growth promoter substitution on performance ,immune responses and serum biochemical parameters in broiler chicks. *Health*. 5(8), 1210-1215.

Goodarzi, M., Nanekaran, S. and Landy, N., 2014. Effect of dietary supplementation with onion (*Allium cepa L*.) on performance, carcass traits and intestinal microflora composition inbroiler chickens.*Asian.Pacific.Journal of Tropical Diseases.*4(Suppl 1), S297-S301.

Kirkpinar, F., Ünlü, H. B., Serdaroğlu, M and Turp, G. Y. 2014. Effects of dietary oregano and garlic essential oils on carcass characteristics, meat composition, colour, pH and sensory quality of broiler meat.*British Poultry Science*, 55:2, 157-166, DOI: 10.1080/00071668.2013.879980.

Kumar, S., Sharadamma, K. C. and Radhakrishna, P. M. 2010. Effects of a garlic active based growth promoter on growth performance and specific pathogenic intestinal microbial counts of broiler chicks.*Int. J. Poult. Sci*., 9: 244-246.

Li C, Wang D, Xu W, Gao F, Zhou G. 2013. Effect of final cooked temperature on tenderness, protein solubility and microstructure of duck breast muscle.*Food Sci Technol*. 51(1):266–274.

Lorenzo, J. M., Gomez, M. 2012. Shelf life of fresh foal meat under MAP, overwrap and vacuum packeaging conditions. *Meat Science*, 92:610-618.

Mahendraker, N. S., Khabe, V. S. and Dan, N. P. 1988. Studies on the effect of fattening on carcass characteristics and quality of meat from BannuLamb.*Journal of Food Science and Technology,* 25: 228- 230.

Mareko, M. D. H., Nsoso, S. J., Mosweu, K., Mokate, K. K. and Madibela, O. R. 2010. Chemical composition and sensory evaluation of broiler supplemented on two levels of Mopane worm (*Imbrasiabelina* (Westwood). *Journal of Agricultural Applied Science*, 6: 223-232.

Meilgaard, M., Civille, G. V., and Carr, B. T. 1999. Sensory evaluation techniques (3.ed., p. 281). New York: CRC.

Muchenje, V., Chimonyo, M., Dzama, K., Strydom, P. E., Ndlovu, T. and Raats, J. G. 2010. Relationship between off-flavor descriptors and flavor scores in beef from cattle raised on natural pasture. *J Muscle Foods*. 21(3):424–432.

Radulovic, S., Pavlovic, M., Sefer, D., Katoch, S., HadziMilic, M., Jovanovic, D., Grdovic, S. and Markovic, R. 2018. Effects of housefly larvae (Muscadomestica) dehydrated meal on production performances and sensory properties of broiler meat. *Thai J Vet Med*. 48:63–70.

Salami, S. A., Luciano, G., O'Grady, M. N., Biondi, L., Newbold, C. J., Kerry, J. P. and Priolo, A. 2019. Sustainability of feeding plant by-products: A review of the implications for ruminant meat production. *Animal Feed Science and Technology* ,251: 37 – 55.

Shahidi, F. and Zhong, Y. 2010. Novel antioxidants in food quality preservation and health promotion.*European Journal of Lipid Science and Technology*, 112, 930–940.

Symeon, G. K., Zintilas, C., Ayoutanti, A., Bizelis, J. A.andDeligeorgis, S. G. 2009. Effect of dietary oregano essential oil supplementation for an extensive fattening period on growth performance and breast meat quality of female medium-growing broilers.*Can. J. Anim. Sci*. 89:331-334.

Valenti, B., Natalello, A., Vasta, V., Campidonico, L., Roscini, V., Mattioli, S. and Luciano, G. 2018. Effect of different dietary tannin extracts on lamb growth performances and meat oxidative stability: Comparison between mimosa, chestnut and tara *Animal,* 1–9.

Waldron, K. W. 2001. Useful ingredients from onion waste. *Food Science Technology* 15(2): 38- 41.

Witte, V. C., Krause, G. F. and Baily, M. E. 1970. "A new extraction method for determining Thiobarbiturie acid values of pork and beef during storage", *J. Food Sci.*, 35:582-585.

Date received: 4th October, 2022
Date accepted: 8th March, 2023