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Augmentation of Meat Quality Attributes of Broilers by Dietary Supplementation of Selenium and Ashwagandha

Manoj Kumar Singh[1], Jinu Manoj[2]*, Dev Sahran Sahu[1] and Yogesh Kumar[1]

[1]College of Veterinary and Animal Sciences, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, INDIA
[2]College of Veterinary Science, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana, INDIA

*Corresponding Author: drjinumanoj@gmail.com

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Abstract

The present experiment was undertaken to explore the possibilities of augmentation of broiler meat quality attributes with dietary supplementation of selenium and ashwagandha (Withania somnifera). The birds were reared with various levels of selenium and ashwagandha in feed for 6 weeks. The broilers were slaughtered as per scientific method at the end of the trial and dressed to produce meat under hygienic conditions at 42 days of age. There was no significant difference observed in dressing percentage and cooking yield among the treatment groups. Physico-chemical attributes of broiler meat revealed that there was a significant ($p<0.05$) increase in moisture, protein, ash content and water holding capacity with a significant decrease in fat and cholesterol content with increasing level of selenium and ashwagandha in poultry feed. There was a non-significant ($p<0.05$) difference observed among meat pH of different groups. The quality of meat was found superior in treatment groups when compared to control group with respect to all the attributes studied viz., appearance, flavor, tenderness, texture, juiciness and overall acceptability on the basis of sensory scores on 9-point Hedonic scale. Out of six groups, the treatment group T5 in which 0.20 mg/Kg selenium and 2.5% ashwagandha was supplemented was found superior with respect to proximate principles as well as sensory attributes. Hence, supplementation of selenium and ashwagandha in poultry feed may be a promising tool for production of nutritionally manipulated poultry meat for health-conscious consumers.

Keywords: Ashwagandha, Broiler, Meat Quality Attributes, Selenium, Physico-chemical, Sensory Evaluation

Introduction

The poultry meat has preference over other livestock meat not only due to its high nutritive and dietary value, but also due to the easy availability and affordable price in the market (Singh *et al*., 2017a). Concept of quality in case of meat products is dynamic, which changes with consumer need, desire for more convenience, variety and concerns about personal health. Recently, consumer demands for quality meat have considerably increased. The growing demand for poultry meat along with higher production should be focused on enhanced meat quality for the satisfaction of health-conscious consumers (Khanapur *et al*., 2017). The quality attributes of meat are its characteristics which include external factors *viz*. appearance, colour, consistency, texture, flavour, grade, standards and internal factors *viz*. fat content, cholesterol content, water holding capacity, pH, antioxidant and microbial properties (Mir *et al*., 2017). The sensory attributes are used to evaluate the consumer preference of meat by sensory panelists (Chumngoen and Tan, 2015).

Improving consumer health and nutritional status by enhancing nutritional profile of broiler meat through dietary approaches is relatively simple and economic method. The diet of poultry influences the meat quality greatly in terms of sensory acceptability, nutritive value and in turn human health. Selenoproteins are necessary for various physiological processes and their deficiency leads to several disorders and injuries in poultry (Ibrahim *et al*., 2019). Selenium can be added as antioxidant to the poultry diet due to its antioxidant effect on cellular membranes and tissue structures resulting in less exudative losses from meat. Supplementation with selenium in poultry feed reduces the drip loss in meat and also reduces the susceptibility of the muscle to the lipid oxidation (Pan *et al*., 2011; Surai, 2018). Fortification of poultry meat with selenium enhances its intake in human also (Ibrahim *et al*., 2019). Ashwagandha (*Withania somnifera*) contains many useful medicinal ingredients, including withanolides (steroidal lactones), alkaloids, choline, fatty acids, amino acids and a variety of sugars. It has immunomodulatory, cardio and neuroprotective, antiaging and antioxidant properties (Singh *et al*., 2016; Thakur *et al*., 2017; Jyotsana *et al*., 2019). Therefore, the supplementation of ashwagandha has significant role in modulating physico-chemical and sensory traits of meat.

The poultry industry should adopt strategies and measures to develop consumer desired meat sensorial and quality attributes in order to satisfy the consumers (Souza *et al*., 2011). Even though some reports are available regarding the effects of supplementation of poultry with selenium or ashwagandha on carcass qualities, the synergestic effect of them on meat quality attributes are not well reported. Therefore, the current experiment was carried out to assess the effect of different levels of selenium and ashwagandha on physico-chemical and sensory traits of broiler meat.

Materials and Methods

Experimental Design

A total of 360 broiler chicks of Vencobb-400 strain were used for the experiment, which was performed at Poultry Research and Training Centre, SVPUAT, Meerut, Uttar Pradesh (India). These chicks were divided into six (T_0-T_5) treatment groups with three replicates of 20 chicks in each group. All the broiler chicks were fed as per BIS feed specifications (2007). Various concentrations of selenium and ashwagandha (*Withania somnifera*) root powder were added into broiler rations *viz.*, T_0 (control group without any supplementation), T_1 (supplemented with ashwagandha 250 mg/Kg), T_2 (selenium 0.15 mg/Kg), T_3 (selenium 0.20 mg/Kg), T_4 (selenium 0.15 mg/Kg & ashwagandha 250 mg/Kg) and T_5 (selenium 0.20 mg/Kg & ashwagandha 250 mg/Kg) with *ad-libitum* fresh water supply. The experiment was conducted for 42 days. A total of 36 broilers (6 from each experimental group) were slaughtered under hygienic conditions at the end of experiment to get meat for the current study, according to the guidelines approved by the Institutional Animal Ethics Committee.

Physicochemical Properties

The dressing per cent and the cooking yield were calculated. The thigh meat was cut into one-inch cubes. Thigh meat chunks were cooked in boiling water containing 2% common salt till internal temperature reached up to 82ºC. Weight of raw and cooked thigh chunks was recorded to calculate cooking yield. The proximate principles of the chicken thigh meat samples *viz*. moisture, fat, protein and ash content were determined (AOAC, 2012). The total cholesterol content was determined as per the procedure described by Dinh *et al*. (2011). Representative samples of 10g of chicken thigh meat from each experimental group were homogenized and the pH of prepared homogenates

was recorded as per AOAC (2012) using a digital pH meter. The water holding capacity of broiler thigh meat samples was also determined as per the method explained by Font-i-Furnols *et al.* (2015).

Sensory Evaluation

Sensory evaluation of control and treatment cubes was conducted by a semi-trained panel consisting of seven panelists. Selection and training of sensory evaluation panelists were performed from 20 potential panelists, using basic taste identification tests (Sharma, 1999; Font-i-Furnols *et al*., 2015). They consisted of students and faculty members of College of Veterinary Science and Animal Husbandry, Meerut, U.P., who were familiar with the characteristics of meat products. Three training sessions were held during preliminary trials before the initiation of this experiment. All sessions were done in an eight-booth sensory panel room at 22°C, equipped with white fluorescent lighting (230V, 35W). The sessions were held 3 hours after breakfast. Three-digit coded samples, two slices (1 cm thickness) of cooked chicken thigh meat (warmed in a microwave oven for 20 seconds) from each group were served on a round plate to the panelists in random order. Panelists were required to cleanse their palates between samples with clean water. The nature of the experiment was explained to the panelists without disclosing the identity of samples. The sensory panelists were asked to rate their preference on a nine-point Hedonic scale, where 9 point was extremely desirable and point 1 was extremely undesirable for different attributes. The panelists judged the samples for appearance, flavour, texture, juiciness and overall acceptability.

Statistical Analysis

All the observed variables were analyzed using one-way ANOVA procedure of SPSS version 20 software. The significant difference between the groups was determined using Duncan's multiple range test at 5 percent level.

Results and Discussion

The effects of dietary supplementation of different levels of selenium and ashwagandha on various physico-chemical properties of broiler meat are given in Table 1. Dressing percentage is an important economic criterion for marketing the meat. In the current study, no significant difference was found in dressing percentage and cooking yield among treatment groups though there a slight reduction of values was observed in control group (72.34±0.01 and 61.96±0.01, respectively). Sanjyal and Sapkota (2011) also observed no significant difference in dressing percentage of broilers supplemented with ashwagandha in feed. Singh *et al.* (2017b) and Mahmood *et al*. (2014) also reported that herbal growth promoters did not exhibit any effect on dressing percentage. However, Ahmed *et al.* (2015) found non-significant increase in dressing percentage in ashwagandha supplemented broilers. Ibrahim *et al.* (2019) reported reduced cooking loss in broilers with selenium supplementation.

Table 1: Effect of different levels of selenium and ashwagandha on physico-chemical properties of broiler meat

Treatment Groups	pH	Cooking Yield (%)	Dressing (%)	Moisture (%)	Fat (%)	Protein (%)	Ash (%)	Cholesterol	WHC
T_0	5.75±0.01	61.96±0.01	72.34±0.01	59.86±0.03^{a}	28.65±0.44^{c}	18.24±0.03^{a}	2.61±0.04^{a}	54.22±0.25^{c}	33.51±0.05^{a}
T_1	5.76±0.01	62.21±0.02	72.39±0.02	60.27±0.02^{a}	28.88±0.38^{c}	19.73±0.05^{a}	2.98±0.05^{a}	52.88±0.19^{b}	34.12±0.06^{a}
T_2	5.76±0.01	62.21±0.02	72.38±0.02	60.35±0.05^{a}	26.53±0.26^{b}	20.26±0.07^{b}	3.15±0.07^{b}	51.75±0.17^{b}	34.46±0.06^{a}
T_3	5.77±0.02	62.22±0.03	72.37±0.02	60.38±0.06^{a}	26.47±0.24^{b}	20.84±0.09^{b}	3.39±0.14^{b}	51.02±0.15^{b}	34.48±0.08^{a}
T_4	5.78±0.02	62.23±0.04	72.42±0.05	61.25±0.22^{b}	26.44±0.20^{b}	21.59±0.13^{b}	3.74±0.13^{b}	48.23±0.09^{a}	36.83±0.18^{b}
T_5	5.77±0.02	62.22±0.03	72.41±0.04	61.89±0.24^{b}	21.62±0.05^{a}	21.71±0.13^{b}	4.94±0.31^{c}	48.22±0.08^{a}	36.81±0.15^{b}

^{abc} *Values bearing different superscripts in same row differ significantly ($p<0.05$)*

Physico-chemical attributes of chicken meat revealed that there was a significant ($p<0.05$) increase in moisture, protein and ash content observed in supplemented groups with maximum value of parameters in T_5 treatment group (61.89±0.24, 21.71±0.13 and 4.94±0.31, respectively). The simultaneous supplementation of selenium and ashwagandha not only increased the protein level but also the ash and moisture contents in broilers. Ash content indicates the mineral status of muscles. Increase in nutritional content in poultry meat is desired by health-conscious consumers. Thakur *et al.* (2017) also reported increased ash content in *W. somnifera* supplemented broilers. There was a significant ($p<0.05$) decrease in fat and cholesterol content with increasing level of selenium and ashwagandha

in poultry feed. Ashwagandha is an ancient herbal medicine with multiple benefits. The withaferin and withanolides found in the roots of *W. somnifera* are responsible for its many biological properties (Thakur *et al*. (2017). Udayakumar *et al*. (2009) reported hypocholesterolemic and hypolipidaemic effects of *W. somnifera*. The flavonoids in ashwagandha decrease cholesterol and triglycerides levels. The withanine and withanolides is having antioxidant properties. Supplementation of *W. somnifera* reduced levels of egg yolk lipids, cholesterol and triglycerides in birds (Qureshi *et al*., 2011). The supplementation of selenium also reduces the fat content in carcasses linearly (Suchy *et al*., 2014). The demand for poultry meat with low level of fat and cholesterol along with higher nutritional content is the need of time.

Water holding capacity of meat is the measure of water it can hold and it affects the sensory attributes directly. In this study, it was found that the water holding capacity of meat increased significantly in treated groups T_4 and T_5 with maximum value observed in T_4 group (36.83±0.18). Increase in water holding capacity enhances the sensory traits like juiciness, tenderness, firmness and appearance which in turn improve the quality and value of meat product (Mir *et al*., 2017). Ibrahim *et al.* (2019) also found increased water holding capacity of broiler meat in their study by supplementation with selenium. There was a non-significant ($p<0.05$) difference among meat pH of different treatment groups which ranged from 5.75 in control group to 5.78 in treated group T_4. All the pH values were observed within the normal pH range of broiler meat. Earlier researchers also observed non-significant difference in meat pH of cob-400 broilers. (Sauza *et al*., 2011, Singh and Pathak, 2019).

The quality of meat was found significantly ($p<0.05$) superior in treatment groups when compared to control group with respect to all the attributes studied *viz*., appearance, flavor, tenderness, texture, juiciness and overall acceptability on the basis of sensory scores on 9-point Hedonic scale (Fig.1). Pandey *et al.* (2013) and Rindhe *et al.* (2012) also found supplementation of ashwagandha in basal diet of broilers significantly improve the sensory qualities of meat. Suchy *et al.* (2014) reviewed that selenium rich poultry meat is juicier with better appearance. The concurrent use of selenium with herbal ingredient ashwagandha was observed as beneficial in improving the desired meat quality attributes.

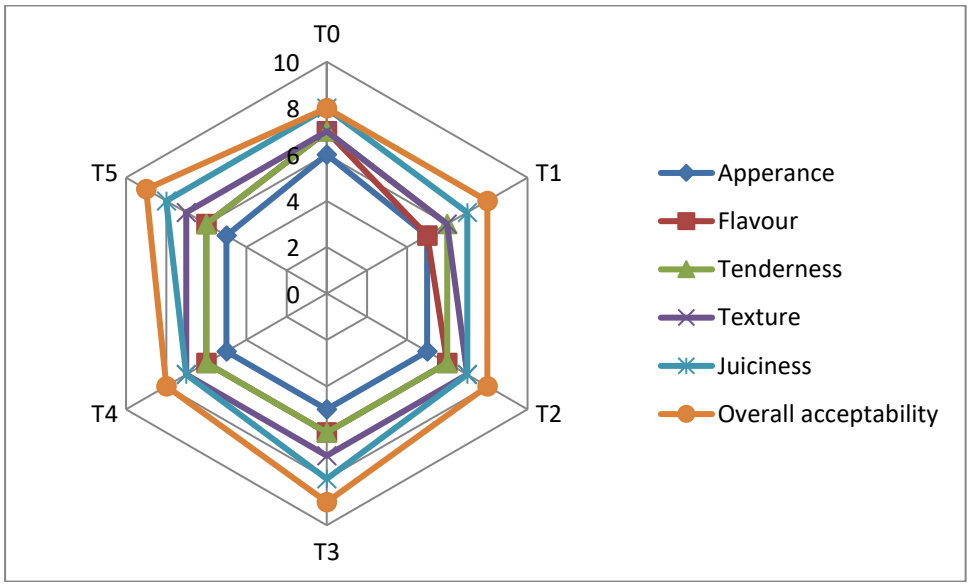

Figure 1: Sensory attribute score of broiler meat treated with different levels of selenium and ashwagandha

Conclusion

In this experiment it was observed that the supplementation of selenium and ashwagandha in poultry feed had improved physico-chemical properties and sensory acceptability scores of broiler meat. Proximate composition of meat was improved in the treated groups when compared to control group. It was found that, out of five supplemented groups, the T_5 treatment group in which 0.20 mg/Kg selenium and 2.5% ashwagandha was supplemented was having highest desired qualities of meat with respect to proximate principles as well as sensory attributes. Hence, the simultaneous supplementation of selenium and ashwagandha at a concentration 0.20 mg/Kg and 2.5% respectively, in poultry feed may be a promising tool for the production of nutritionally manipulated meat for health-conscious consumers

Conflict of Interests

There is no conflict of interest.

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