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Effect of herb *Urtica dioica* as feed additive on carcass traits and oxidative stability of meat in broilers

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Abstract
A research was carried out to evaluate the effect of herb *Urtica dioica* as feed additive on carcass traits and oxidative stability of meat in broilers. A completely randomized design was used with 120 broilers, divided in four treatments with three replicates each (10 birds in each replicate). The treatment groups consisted of group T_1 - offered basal diet without feed additives which served as control, group T_2 - basal diet + 1% nettle on D.M basis, group T_3- basal diet + 1.5% nettle and group T_4- basal diet + 2% nettle. The results revealed that there was a significant difference on dressing percentage of carcass in birds of various treatment groups in comparison to control; however other carcass parameters could not reach a statistical difference. The oxidative stability of meat, expressed in terms of Malondialdehyde concentration differed significantly ($P \leq 0.05$) between different treatment groups. The Malondialdehyde concentration in treatment group T_4, given 2% of *Urtica dioica* was the lowest in comparison to control. The overall results depicted that the use of nettle as feed additive in broiler diet had positive effects on dressing percentage of carcass and the oxidative stability of broiler meat.

Keywords: *Urtica dioica*, herb, carcass traits, oxidative stability, broilers

Introduction
Over the past few decades, livestock sector has undergone change at an unprecedented pace owing to the booming demand for foods of animal origin in the rapidly growing world economies. There has been a rapid global expansion of production and consumption of animal products which is expected to continue at an exponential pace due to increasing local demands. Increasing productivity by most efficient use of production inputs in the livestock sector has to be fundamental if the sector is to meet the growing demand for quality livestock products whilst minimizing its impact on environmental and the world's natural resources [1]. The sector is currently constrained by lack of skills, knowledge and appropriate technologies especially in small to medium scale production systems. However; adapted breeds, selective use of local feed resources and feed additives coupled with effective animal health interventions have increased animal production considerably. Feed is the major input in the broiler industry and contributes to about 70-80% of the total cost of production, thus playing an indispensible role in poultry production. With the recent rise in its cost internationally, the bird's ability to convert nutrients has emerged as an important factor for overall performance efficiency of the broiler industry. Increasing demand for poultry products has also led to the use of feed additives viz. hormones, antibiotics, probiotics, enzymes, organic acids, etc. that are known to stimulate growth, improve health and also possess antioxidant and antimicrobial activities [2]. Despite their effectiveness as growth promoters, however, the use of antibiotics has caused various diseases among both consumers and birds, thereby limiting their use in the poultry industry. Restrictions on the use of antibiotics as feed additives have since been enforced in many European countries owing to increased antibiotic resistance exhibited by the pathogens.
Living organisms produce reactive oxygen species under the influence of biotic and abiotic factors. As a result of the increase in the levels of these ROS at the cellular level, oxidative stress occurs [3]. Antioxidant defense system functions in reducing the effect of oxidative stress. In cases where the antioxidant system is insufficient, taking products with antioxidant properties from outside reduces the effects of oxidative stress [4]. For decades, oxidation processes have been the focus of animal scientists for their negative impact on growth performance and food quality in broilers, it is therefore, a requirement to develop a system of optimal antioxidant supplementation for optimal growth and production of poultry birds [5].

Synthetic antioxidants have commonly been used in the poultry diets for increasing the feed efficiency and the growth in broilers. Their use is, however, under scan for their long term detrimental effects on the human health for being potential carcinogens [6]. Development and utilization of antioxidants of natural origin are, therefore, in demand for making the industry more acceptable vis-à-vis human health. Plants are an important source of supplemental antioxidants [7]. Keeping this context in mind, it is very important to investigate the antioxidant activities of plants in terms of their use.

With increasing acceptance of traditional medicine as an alternative to health care system, screening of plants for presence of active compounds has gained extra-ordinary importance in the recent past [8]. Exploration of locally available natural feed additives of plant origin has further attracted considerable interest in the field of poultry science for healthy production of broiler meat. The use of herbs as natural feed additives in poultry feed has not only reduced the production cost but has also helped to overcome problems surfaced due to the use of synthetic growth promoters. Their use will go a long way in attracting new entrepreneurs and also help sustenance of broiler industry in the highly competitive present day markets. Herbs are not only cheap and affordable but are also safe with no or minimal side effects [8]. Their positive impact is due to stimulation of appetite and feed intake; improvement of endogenous digestive enzyme secretion and activation of immune response besides having antiviral, antioxidant and anti-helminthic properties [9]. Their inclusion in the diet can enhance the bird's performance, improve feed utilization, maintain health and alleviate adverse effect of environmental stress.

Many herbs have a long history of preventing or treating human and animal ailments. Aromatic plants have been used traditionally for management of different human diseases world-wide. Among such medicinal herbs is stinging nettle (*Urtica diocia*).

Urtica dioica is a perennial plant belonging to the Urticaceae family and is commonly known as stinging nettle. Nettle is found in abundance in Northern Europe and much of Asia, particularly in the Himalayas from Kashmir to Kumaon region [10]. A perfect packing of several chemical compounds and nutrients coupled with its availability as a natural herb through all the seasons of the year particularly in most parts of India, makes nettle unique for its bioactivities and medicinal properties and as such makes it a suitable herb candidate for cost effective animal nutritional studies. Nettle leaves are reported to be an excellent and easily available source of protein as well as vitamins. On an average, the leaves contain about 26% protein on DM basis [11]. Amino acids in nettle leaf meal are nutritionally superior to those of alfalfa meal. It is rich in vitamins A, C, Fe, K, Mn and Ca [12]. This makes the leaves suitable for feeding animals particularly chickens.

Keeping these points in mind, a research was designed to study the effects of this locally available medicinal herb on the carcass traits and oxidative stability of meat of broilers.

Materials and Methods

The research was carried out at Instructional Poultry Farm of the Division of Livestock Production and Management and Division of Animal Nutrition, SKUAST Kashmir. Stinging nettle (*Urtica dioica*) was collected from the vicinity of faculty of veterinary sciences and animal husbandry, Shuhama, freed from dust and sand, spread on a clean polythene sheet and dried under shade. Leaves were separated from the stems and crushed to a fine powder and kept in clean, airtight containers after proper labeling. The powder was then stored at room temperature for further use.

A growth trial was conducted to determine the effect of herbal feed additive on performance of broilers. Day old commercial broiler chicks were procured from a reputed hatchery and brooded for one week under common brooding conditions. On 8th day, the chicks were distributed into four treatment groups having three replicates with ten chicks in each replicate. Birds of treatment group T_1 were offered basal diet without feed additives. Birds of treatment group T_2 were offered basal diet with nettle @ 1% of feed on D.M basis. Birds of treatment group T_3 were offered basal diet with nettle @ 1.5% of feed on D.M basis. Birds of treatment group T_4 were offered basal diet with nettle @ 2% of feed on D.M basis. Diets were formulated as per ICAR (2013) requirements. All the treatment groups in the trial were reared under similar managemental conditions like space, light and ventilation, under thermo-neutral environment (23.28 - 23.50 °C) with the help of room heating equipment for up to five weeks of age with *ad lib* feeding and watering. All birds were vaccinated and assessed twice daily for mortality, if any. At the end of the trial, a total of 24 healthy broiler chickens (2 birds per replication, or 6 birds per treatment) were selected for slaughter and carcass analysis. The birds were fasted overnight and water was withdrawn three to four hours before slaughter. The birds were weighed to determine their pre-slaughter live weight and then slaughtered. After bleeding, the carcasses were weighed to ascertain the amount of blood lost. The carcass was then scalded for 1.5 minutes at 600 degrees Celsius. To calculate the feather loss, feathers were plucked and the de-feathered weight was recorded. The head and shanks were removed and carcasses were visually observed for grading as per the standard procedure (BIS Grading). The carcasses were eviscerated by removing the interior contents after vents were opened. For each carcass, the eviscerated weight and weight of giblets (heart, liver, and gizzard) were calculated and expressed as a percentage of pre slaughter live weight. The carcass was cut into standard portions such as breast, thighs, drumsticks, wings, back, and neck, with each part weighing separately. On day 30th of storage, the oxidative stability of broiler meat was assessed by determining Thiobarbituric Acid Reactive Substances (TBARS) value by a method described by Witte *et al.* [13].

Statistical Analysis

The data was analyzed using one way ANOVA. The test statistics were then compared against p-values to determine their significance and the analysis was conducted using the statistical software SPSS version 20.00 Chicago, United States of America for Windows.

Results and Discussion

The effect of diets supplemented with herb *Urtica dioica* on different slaughter and carcass traits in broilers is presented in Table 1. The results show that the feeding of different levels of herb had a significant effect on the dressing percentage of carcass without having any significant effect on other carcass traits among various treatment groups. The results of oxidative stability of meat (TBARS) are presented in Table 2. The results indicated a significant difference in oxidative

stability of meat among different treatment groups. It was seen that the birds of all treatment groups had a significantly lower value of TBARS in comparison to control and best results were observed in group T_4 given nettle @2%.

The most relevant parameters that are used to evaluate the carcass quality of broilers are carcass yield, commercial cuts and breast yield meat. Very few reports on the effect of nettle supplementation on carcass quality and yield are available in the literature and generally it is seen that supplementation of nettle can have varied effects on the slaughter and carcass parameters in broilers. The results of our experiment revealed that the supplementation of nettle at various levels in the broiler diet significantly improved the dressing percentage of broiler but its effects on various carcass parameters could not reach a significant difference. The percentage of breast, thighs and drumsticks amongst various treatment groups did increase numerically due to nettle supplementation but could not reach a significant difference in comparison to control.

A study conducted by Safa mehr *et al* [14] revealed that birds fed with 1% dietary nettle had the highest carcass yield among different groups however nettle supplementation had no effects on percent of breast, thigh, and abdominal fat. Nobakht *et al*. [14] also reported a similar trend in the relative weight of different organs of birds fed nettle as feed additive. Keshavarz *et al*. [15] in his study reported that effects of different levels of *Urtica dioica* powder and essential oil had no significant effects on carcass traits of broilers. Meimandipour *et al*. [16] in his study reported that there was no significant ($P > 0.05$) effect on different carcass traits and relative organ weight, including percentages of carcass, breast, thigh, liver, intestines and total gastrointestinal tract in broiler chickens fed nano-encapsulated aloe vera, dill and nettle root extract as feed antibiotic substitute. Melesse *et al*. [17] in his study also reported that feeding different levels of stinging nettle leaf meal to hubbard broiler chickens resulted in non-significant difference ($P > 0.05$) in total edible offal across different treatment groups. Ali, [18] in his study reported the effects of different levels of chicory zizaphora nettle and savoury medicinal plants on carcass characteristics of male broilers and concluded that different levels of savoury could not affect the carcass characteristic in broilers, whereas different levels of chicory, zizaphora and nettle could effectively improve the carcass characteristics of broilers. Nasiri *et al.* [19] conducted an experiment to evaluate the effects of different levels of nettle in starter and grower feeds on carcass traits of broilers. According to his study, the incorporation of 1.5% of nettle in starter and grower feeds produces a positive effect on carcass traits of broilers. Somaieh *et al*. [20] reported that varying levels of nettle in starter and grower feeds had large effects on carcass traits of broilers. Mehdi *et al*. [21] studied carcass characteristics of broiler chickens fed diets containing nettle powder or essential oil and concluded that inclusion of nettle EO at 10g/kg in the broiler diet could induce a potential towards improving internal organs. Stojcic *et al*. [22] studied the effect of the influence of rearing system and nettle supplementation on the carcass traits and fatty acid composition of redbro broilers. According to his study, fresh nettle added to the diet beneficially affected the fatty acid profile and improved the quality of chicken breast meat more than pasture intake. Behboodi *et al*. [23] conducted an experiment to evaluate the nutritional impacts of nettle extract on the carcass parameters in broiler chickens. It was seen that treatments containing nettle extracts showed a significant increase in thigh yield compared to the control treatment ($P < 0.05$).

It is believed that the presence of antioxidants and phenolic substances in nettle may be responsible for an increase in the percentage of breast, thigh and drumstick in broilers Lee *et al*. [24]. In addition to this, carvacrol present in nettle has stimulatory effects on pancreatic secretions, due to an increase in these digestive secretions more amounts of nutrients like amino acids get digested and absorbed in the tract, thereby improving their dressing percentage. These increased amounts of absorbed amino acids are also responsible for an increase in the percentage of organs like breast and thigh in broilers.

A high proportion of fatty acids present in broiler meat are unsaturated which are prone to lipid oxidation and thus require special attention. The addition of phytogenic compounds such as herbs, spices or essential oils in foods of animal origin contribute to food safety and are known to decrease oxidation of animal products through their antioxidant function. [25]. Loetcher *et al*. [26] in a study reported that nettle contains alpha tocopherol, flavonoids, ferulic acid and carotenoids which act as natural antioxidants. Loetcher *et al*. [27] in his study reported that diets supplemented with nettle had a positive effect on the lipid oxidation stability in broiler meat. A similar result was also seen by Ahmadipour and Khajali, [28] who reported that nettle powder at 1.5% had positive effects on broilers exposed to oxidative stress and also reduced lipid peroxidation and circulating MDA. Jang *et al*. [29] reported that dietary medicinal herb extract mix appeared to delay the lipid oxidation of broiler chicken breast meat. Mehmet *et al*. [20] also reported that nettle seed decreased the elevated MDA and liver enzyme levels in rats and also increased the antioxidant enzyme levels in rats. Behboodi *et al*. [30] in his the experiment reported that nettle extract improved the antioxidant status of broiler chickens. Toldy *et al*. [31] reported a decrease in reactive oxygen species in the brain of rats when their feed was supplemented with 10 g/kg of dried nettle leaves. Thus it is clear that medicinal herbs like nettle contain several phytochemicals which have potent antioxidant activities through which they improve the quality of meat products [25].

Urtica dioica: Fresh and dried form

Slaughter and Carcass traits of experimental birds

Table 1: Carcass traits of broilers fed *Urtica dioica* as feed additive

Cutability Parameters (%)	Dietary treatments			
	T_1	T_2	T_3	T_4
Blood loss	5.56 ±1.10	6.21±1.26	4.63±0.56	5.52±0.47
Feather loss	8.29 ±0.22	8.42± 0.55	9.29 ±0.59	9.50 ±0.40
Dressing percentage	72.04^{a} ±2.37	73.77^{ab}±0.85	75.62^{b}±0.96	76.62^{c}±0.86
Breast	33.98±0.16	34.64±0.48	35.63±1.43	36.43±1.06
Drumsticks and Thigh	24.70±0.55	26.25±0.64	25.50±0.66	27.14±0.11
Wings	11.79±0.072	11.19±0. 30	11.22±0. .422	11.17±0. 25
Back	16.70±0.40	19.18±0.17	17.04±0.56	18.04±0.73
Neck	7.25±0.28	7.16±0.29	6.44±0.29	7.19±0.52
Giblet	5.94 ±0.05	6.83± 0.37	5.77± 0.38	6.78± 0.29
Visual carcass score	A	A	A	A

Means with different superscripts in same row differ significantly (P≤0.05)

Table 2: TBARS assay of meat of broilers fed *Urtica dioica* as feed additive

TBARS (nmol MDA/mg of meat)	T_1	T_2	T_3	T_4
	0.55^{b}± 0.020	0.48^{ab}± 0.01	0.47^{ab}± 0.01	0.43^{a}± 0.008

Means with different superscripts in same row differ significantly (P≤0.05)

Conclusion

Thus from the present study, it was concluded that supplementation of herb *Urtica dioica* at different levels as feed additive in broiler diets had significant effects on dressing percentage of broilers and considerably improved the oxidative stability of broiler meat. Further studies however are needed to investigate the bioactive components of nettle and their respective modes of action on carcass traits in broilers.

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