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Original Research Article

Antioxidant Potential of Raw Meat from Broiler Chicken Fed with Dietary Plant Supplements

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Abstract

In Nepal, medicinal herbs have traditionally been used to feed animals for growth and during illness. This study was conducted to evaluate the antioxidant property of thigh and breast meats obtained from chickens fed with medicinal plants incorporated feeds. Two hundred broiler chickens were randomly assigned to 5 groups. The treatment groups were fed with medicinal herbs supplemented feeds, while the control group was fed with a commercial diet. The aqueous fractions of thigh and breast meats showed significantly higher total phenolic content than control (P = 0.05). Among thigh meats, *Melochia corchorifolia* supplemented feed resulted the highest total phenolic content (109 ± 4.5 mg CE/g), followed by *Moringa oleifera* supplemented one (104 ± 5.8 mg CE/g). On carrying out DPPH scavenging activity, thigh meat from chicken fed with *Leucaena leucocephala* supplemented feed had 45.8 % inhibition compared to control (34.7% inhibition). The lipophilic fractions had significantly lower total phenolic content and DPPH scavenging activity. Sensory analyses revealed that meats from chickens fed with *Melochia corchorifolia* and *Alpinia zerumbet* herbs had superior flavor, whereas chickens fed with *Moringa oleifera* had objectionable taste. Poultry feed supplemented with *Melochia corchorifolia* and *Alpinia zerumbet* could significantly improve the antioxidant activity and flavor of chicken meat.

Keywords: chicken meat, antioxidant, DPPH, total phenolic, feed supplement

Introduction

Chicken meat is one of the widely consumed foods throughout the world. Basically, it is considered as a source of protein and to a lesser extent, fat. Although meat is generally not assumed to have antioxidants, researches have shown that feed supplement increases the antioxidant potentiality of meat and meat products (Khaligh et al., 2011; Narimani-Rad et al., 2011). The most common antioxidant used in poultry feeds includes vitamin E, however, it has several concerns like its synthetic origin, limited bioeffciency, potential prooxidant property and non-homogenous distribution (Brenes et al., 2008). Therefore, a paradigm shift from synthetic to more natural antioxidant usages in animal feed is taking place. In this regard, researchers have shown an increase in the antioxidative potential of broiler meat as a result of the grape pomace administration in broiler feed (Goni et al., 2007; Jang et al., 2008).

In the current study, dried leaf powders of four plants were separately mixed with poultry feed and administered to chicken. The chicken meats were analyzed for total phenolic content and DPPH free radical scavenging activity.

Materials and Methods

Birds

A total of 200 Ross-308 one day old male broilers were provided by a local broiler breeder company, and randomly allocated into five dietary treatments. The birds were given 23 L : 1 D lighting program during 24 h period throughout the 45 days of trial.

Diets

Starter diets were offered from day 1 to 21, and grower diets were continued until day 45. Feed and water were provided with adlibitum throughout the study. A basal diet without additive was considered as a control. For the treatments, the dried leaf powder of the selected plants was mixed with the feed at the rate of 1 mg/g body weight. The plants used were *bankuro*

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(*Melochia corchorifolia*), alpinia (*Alpinia zerumbet*), leuceana (*Leuceanalu cocephala*), and drumstick (*Moringa oleifera*).

Sampling

The birds were slaughtered at day 45 under commercial conditions. Breast and thigh meats were removed from each carcass upon slaughter. All samples were stored at -20 °C until analysis. Thigh and breast meats (n=3) from each feed group, were thawed overnight at 4 °C and minced through 5-mm plates.

Lipophilic and hydrophilic fractions were obtained from each sample (Sacchetti et al., 2008) and analyzed for total phenol content and antioxidant activity.

Total Phenolic Content (TPC)

The amount of total phenolics of the samples was determined using Folin-Ciocalteu reagent (Upadhyay et al., 2013) and expressed as catechol equivalent (CE) in mg/g sample, with slight modifications. Briefly, to 1 mL of test samples, 1 mL of Folin reagent, and 0.8 mL of sodium carbonate (7.5%) were added. The mixture was allowed to stand for 30 min and the absorbance was measured at 765 nm using UV-Vis spectrophotometer.

DPPH scavenging activity

The DPPH free radical scavenging activity was performed as reported previously (Upadhyay et al., 2014). Briefly, 1 mL of sample of different concentrations was mixed with 0.5 mL of 0.5 mM DPPH solution and 1 mL of sodium acetate buffer (pH 5.5). The mixture was incubated in dark for 30 min at room temperature. Absorbance was measured at 517 nm using UV-vis spectrophotometer, and the DPPH radical scavenging activity was calculated using the formula:

% DPPH scavenging activity = $[(A_c - A_s)/A_c] \times 100$,

Where A_c is the absorbance of the control (DPPH solution without test sample) and A_s is the absorbance with test sample.

Statistical Analyses

Data analysis was performed using the Statistical Package for Social Sciences (SPSS, version 20.0, SPSS Inc., Chicago, Ill., USA) for Windows. Multiple comparisons between groups were performed by one-way analysis of variance supplemented with Tukeys HSD *post hoc* test. Significance was accepted at *P* lower than 0.05 or 0.01.

Results and Discussion

Total phenolic contents of lipophilic fractions

The total phenolic content (TPC) gives a measure of the amount of phenolic acid and flavonoid present in a sample. The TPC of thigh meat from *Alpini*a and *bankuro* fed chickens were significantly higher compared to control with respective values of 20.9 ± 1.5 and 20 ± 0.9 mg CE/g sample (Figure 1.; at P = 0.01). However, TPC of thigh meats derived from *Leuceana* (11.8 ± 0.7) and drumstick (10.9 ± 1.8) fed chickens were not significantly different from control (11.5 ± 1.1) at P = 0.01. TPCs of Breast meats derived from drumstick, bankuro, and *Alpinia* fed chickens were significantly higher than control with the respective values of 21.9 ± 1.1, 20.3 ± 1.2, 15.5 ± 1.1, and 8.8 ± 0.8 mg CE/g sample (Figure. 1.; at P = 0.01).

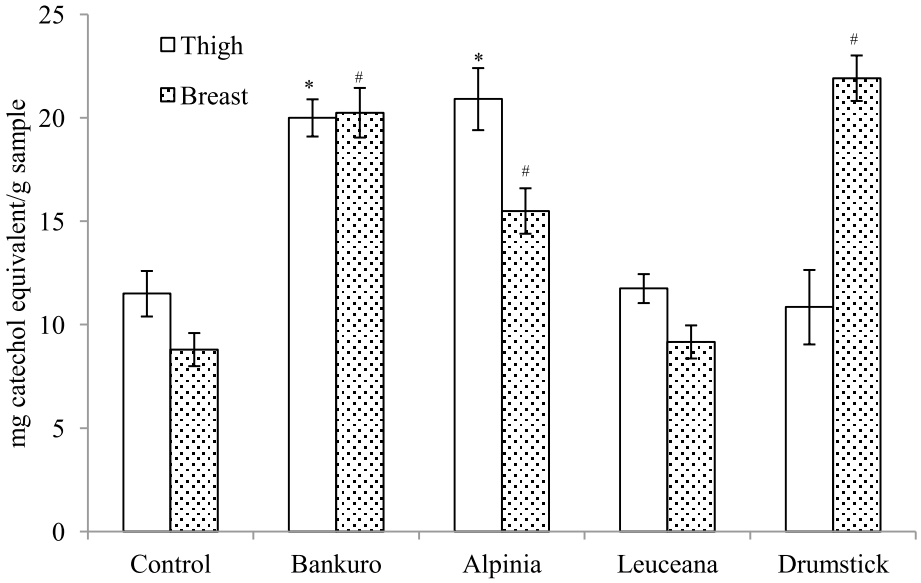

Figure 1. Total phenolic contents (mg CE/g sample) of lipophilic fractions

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Total phenolic contents of aqueous fractions

The aqueous fractions for all treatments exhibited higher phenolic contents. Thigh meats fed with *bankuro* and drumstick had significantly higher TPCs of 109 ± 4.5 and 104 ± 5.8 mg CE/g sample respectively, while the control had 83.2 ± 7.9 mg CE/g sample (Fig. 2.; at $P = 0.01$). Similarly, the *Alpinia* (99.1 ± 3.8) and *Leuceana* (97.3 ± 4.3) fed thigh meat samples had significantly higher values TPC at $P = 0.05$ (Fig. 2). For breast meat, samples fed with drumstick (139.2 ± 2.1), *Alpinia* (119.7 ± 4.9), and *bankuro* (118.4 ± 3.2) were found to have significantly higher TPC compared to control (107.6 ± 3.8; Fig 2, at $P = 0.01$).

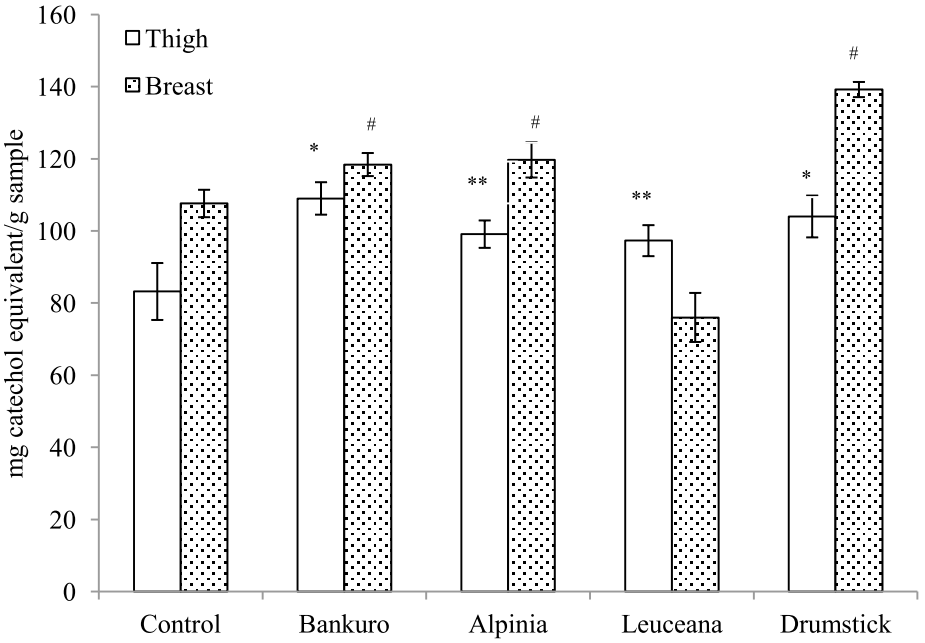
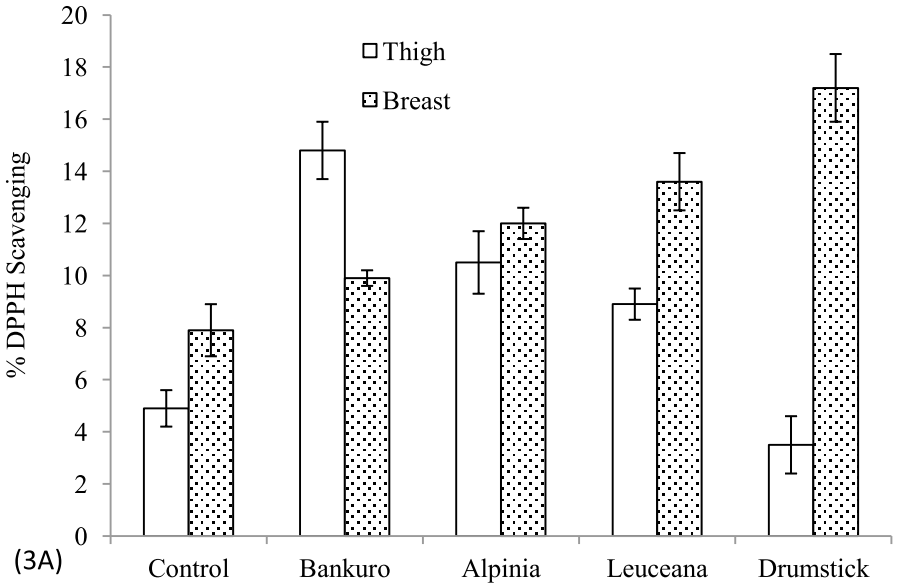


Fig. 2. Total phenolic content (mg CE/g sample) of aqueous fractions. The symbols * and # denote significant differences for thigh and breast meat respectively at $P = 0.01$, and ** denotes significant difference at $P = 0.05$).

DPPH radical scavenging activity

The DPPH free radical scavenging activity of meat samples from lipophilic and aqueous fractions are shown in Fig. 3A and B. The results show that most of the samples had higher scavenging activity than control. Interestingly, the lipophilic breast and aqueous thigh had better DPPH free radical scavenging activity.



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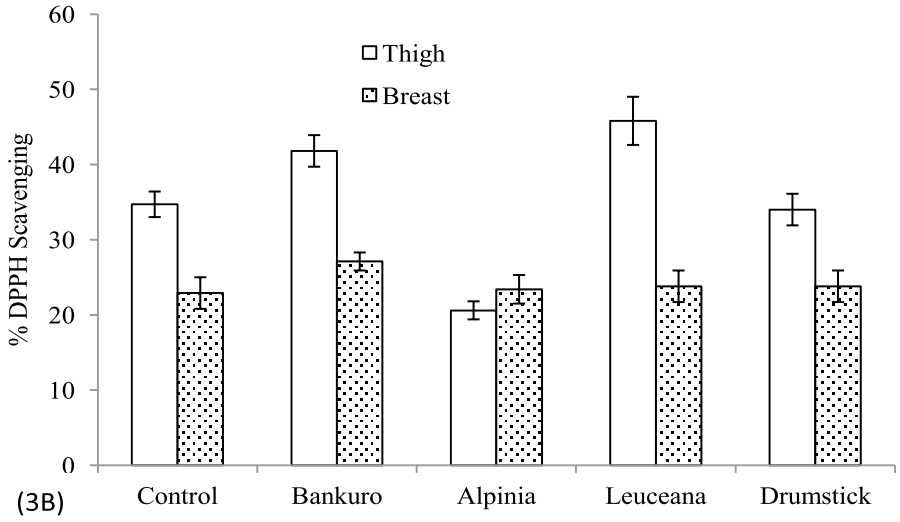

Fig. 3A and B: DPPH free radical scavenging activity (%) of lipophilic (A) and aqueous fractions (B).

Meat is not considered as a source of dietetic antioxidants; therefore, we wanted to investigate if the herbs used as a feed supplement could increase the total phenolic content of the meat. The herbs chosen for this study are known to have considerable antioxidant activities with significant total phenolic constituents (Upadhyay et al., 2013, Elzaawelly et al., 2007; Chanwitheesuk et al., 2005; Moyo et al., 2012; Rao et al., 2013). The increase in total phenolic contents and hence antioxidant activity indicates that the herbs have contributed in developing antioxidant meat. The aqueous fraction had higher amount of TPC than that of lipophilic fraction indicating the presence of more water soluble phenolic constituents in meat. On sensory analysis (data not shown), it was found that chicken fed with drumstick leaf powder had objectionable flavor. Therefore, although the same meat had higher amount of total phenolic content, the leaf may not be suitable for further application unless the flavor is removed. Our results identified *bankuro* and *Alpinia* as a promising feed supplement for poultry feed, however, further research, such as TBARs estimation, is required to use it in industrial scale.

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