SUPPLEMENTATION OF MEDICINAL HERB INCRASED ANTI-OXIDATIVE ACTIVITY OF RAW CHICKEN BREAST AND THIGH MEAT

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Introduction

Oxidative quality deterioration of meat can be reduced by conventional antioxidants, butylated hydroxyanisole, butylated hydroxyl toluene, tetiarybutyl hydroquinone and propyl gallate. Since such synthetic antioxidants have shown toxicity (Han and Rhee, 2005), the needs of searching natural antioxidants has occured. Medicinal herb extracts have shown an antimicrobial and antioxidative effect *in vitro*, especially polyphenols of the extracts were readily react with single electron oxidants, resulting in powerful free-radical scavenging activity and complex wit metal ion prooxidant to curtail anti-oxidant reactions (Decker and Xu, 1998). However, the effect of supplementation of natural products on the antioxidative activity of animal muscle is still controversial (Vinchi et al., 2001).

Therefore, the objective of present study was to evaluate the effectiveness of dietary medicinal herb extracts on anti-oxidative activity of raw chicken breast and thigh from broilers during cold storage at 4℃ for 2 weeks.

Materials and Methods

Medicinal herbs (*Morus alba* L , *Coptis chinensis*, and *Lonicera japonica* Thunberg) chopped, ground to pass mesh (2 mm) and powdered and extracted overnight with 75% MeOH. The concentrate of each medicinal herb was mixed with ratio of 48.5:48.5:3.0 and used as medicinal herb extracts.

Day-old Cobb 500 (n=480) broiler chickens were obtained from a local commercial hatchery. Chickens were randomly assigned into three groups. A control group (C) was fed a basal diet and the other groups were fed basal diets supplemented with 0.3 (T1) and 1.0% (T2) medicinal herb extract kg^{-1} feed (Table 1). The feeding trial for broilers composed of a starter diet until 21 d of age and grower diet until 35 d of age. Diets of control and treatments group achieved the same energy and protein levels with the extracts addition. At day 36, the broilers were sacrificed and breast and thigh were immediately removed from the carcass then air packaged and stored in a refrigerator (4℃) until used.

The total polyphenol content of the meat was estimated colorimetrically using the Folin–Ciocalteu method (Subramanian et al., 1965). The content was calculated based on a standard curve generated with gallic acid. Antioxidant activity of the medicinal herb and the meat was determined by DPPH radical scavenging activity (Blois, 1958). Lipid oxidation was determined as a 2-thiobarbituric acid reactive substances (TBARS) value using the method described by Ahn et al. (1999) with some modifications and the value was reported as mg malondialdehyde/kg meat. One way analysis of variance was performed using SAS (SAS Institute, Cary, NC, USA) software (SAS, 2000) and the Duncan's multiple range test was used to compare the differences among the mean values of each experimental days. Mean values with pooled standard errors of the mean (SEM) were also reported, and the significance was defined at $p< 0.05$.

Results and Discussion

Total phenol content (TPC) of raw chicken breast and thigh of broilers fed medicinal herb extract was shown in Fig. 1. Significant difference was found on initial day of the experiment, which was shown that the TPC of control, T1, and T2 was 48.82, 95.59, and 99.26 ppm, respectively. With comparison of the TPC of chicken breast the TPC of chicken thigh was lower through whole storage. This phenomenon may due to higher amount of fat in chicken thigh muscle than those of breast and had relatively low polyphenol contents. In addition, there was no significance found among treatments in chicken thigh muscle.

DPPH is a free radical compounds and has been used to determine the free-radical scavenging activity of various samples (Flaczyk et al., 2006). In chicken breast, DPPH radical scavenging activity of T2 was 15-17% higher ($P <0.05$) than those of control and T1 at day 0 (Table 2). Similar result was shown in chicken thigh at Day 0, indicating that T2 was significantly higher ($P<0.05$). This result suggested that dietary medicinal herb for broilers could positively affect on DPPH radical scavenging ability of chicken breast and thigh muscle. However, this activity was not significantly changed by treatment during storage at 4℃.

The effect of dietary supplementation with medicinal herb extract on lipid oxidation in chicken breast and thigh meat stored at 4℃ for 0, 3, 7, and 14 days is in Table 3. TBARS values of T2 were lower than that of control up to Day 7 however, no significance was found in breast. Interestingly, at Day 7 and 14, lipids oxidation was significantly decreased in T2 compare to control's ($P<0.05$). From this result, it was concluded that the medicinal herb supplementation may lower the oxidation susceptibility of chicken thigh during cold storage.

Conclusions

The dietary supplementation of medicinal herb extract to chicken broilers may affect on the polyphenol content retained and anti-oxidative activity in chicken breast and thigh meat. From this result, the medicinal herb can be considered alternative natural andtioxidants to retard quality deterioration of chicken meats during cold storage.

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Table 1. Experimental formula of broiler diets

	Diets[1]		
	Control	T1	T2
Ingredients:			
Corn	58.99* (62.89)†	58.99 (62.59)	58.99 (61.89)
Soybean meal	24.02 (24.01)	24.02 (24.01)	24.02 (24.01)
Corngluten meal	8.51 (5.01)	8.51 (5.01)	8.51 (5.01)
Wheat bran	3.00 (3.00)	2.70 (3.00)	2.00 (3.00)
Soybean oil	2.00 (2.00)	2.00 (2.00)	2.00 (2.00)
TCP	1.78 (1.23)	1.78 (1.23)	1.78 (1.23)
Limestone	0.79 (1.10)	0.79 (1.10)	0.79 (1.10)
Salt	0.40 (0.40)	0.40 (0.40)	0.40 (0.40)
DL-methionine	0.19 (0.08)	0.19 (0.08)	0.19 (0.08)
L-lysine HCl	0.12 (0.08)	0.12 (0.08)	0.12 (0.08)
Vitamin premix[2]	0.10 (0.10)	0.10 (0.10)	0.10 (0.10)
Mineral premix[3]	0.10 (0.10)	0.10 (0.10)	0.10 (0.10)
Medicinal herb	0	0.3 (0.3)	1.0
	100	100	100
Chemical composition:%			
ME (kcal/kg)	3,100 (3,100)	3,100 (3,100)	3,100 (3,100)
CP	21.00 (19.00)	21.00 (19.00)	21.00 (19.00)
Ca	1.00 (0.90)	1.00 (0.90)	1.00 (0.90)
Lysine	1.10 (1.00)	1.10 (1.00)	1.10 (1.00)
Methionine	0.50 (0.38)	0.50 (0.38)	0.50 (0.38)
AP	0.45 (0.35)	0.45 (0.35)	0.45 (0.35)

1 Control : 0% Medicinal herb; T1 : 0.3% Medicinal herb; T2 : 1.0% Medicinal herb

2 Provided per kilogram of diet: Vit. A, 5,500 IU; Vit. D3, 1,100 IU; Vit. E, 11 IU; Vit. B12 0.0066mg; riboflavin, 4.4mg; niacin, 44mg; pantothenic acid, 11mg (Ca-pantothenate, 11.96mg); choline, 190.96mg (choline chloride 220mg); menadione, 1.1mg (menadione sodium bisulfite complex, 3.33mg); folic acid, 0.55mg; pyridoxine, 2.2mg (pyridoxine hydrochloride, 2.67mg); biotin, 0.11mg; thiamin, 2.2mg (thiamine mononitrate, 2.40mg); ethoxyquin, 125mg.

3 Provided in mg per kilogram of diet; Mn, 120; Zn, 100; Fe, 60; Cu, 10; I, 0.46; Ca, min: 150 max: 180.

***** Formula of starter diet

† Formula of grower diet

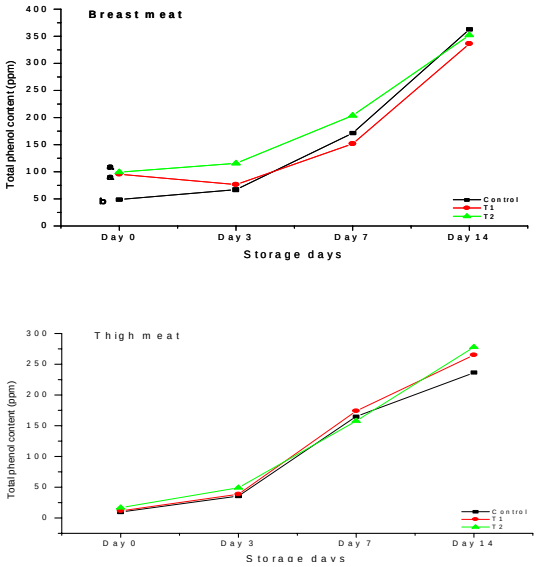

Fig. 1. Total phenol content of chicken breast and thigh meat during cold storage at 4℃

Table 2. DPPH scavenging activity of chicken breast and thigh meat during cold storage (4℃)

	Treat	Storage Days			
		0	3	7	14
Breast	Control	20.82b	21.68	24.15	21.97
	T1	23.39b	27.38	23.39	23.37
	T2	37.28a	30.52	25.68	22.74
	SEM[1]	2.193	4.056	2.417	2.349
Thigh	Control	5.34b	23.39	32.56	36.80
	T1	4.77b	24.39	40.97	37.55
	T2	6.91a	28.74	33.33	33.01
	SEM[1]	0.243	2.054	2.070	1.891

[1] standard error of the mean

[a-b] Means with different superscripts differ significantly (P<0.05)

Table 3. TBARS values of chicken breast and thigh meat during cold storage (4℃)

	Treat	Storage Days			
		0	3	7	14
Breast	Control	0.48	0.60	0.75	0.32
	T1	0.43	0.49	0.49	0.35
	T2	0.39	0.42	0.52	0.43
	SEM[1]	0.031	0.05	0.05	0.05
Thigh	Control	0.40	0.75	0.61a	0.52a
	T1	0.42	0.70	0.46b	0.51a
	T2	0.50	0.62	0.42c	0.44b
	SEM[1]	0.021	0.041	0.002	0.012

[1] standard error of the mean

[a-b] Means with different superscripts differ significantly (P<0.05)