EVALUATION OF GREEN TEA EXTRACT AS ANTIOXIDANT IN SEMI-DRIED SWEET PORK

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Abstract – The objective of this study was to evaluate the effect of green tea extract on antioxidant properties, lipid oxidation and sensory evaluation of semi-dried sweet pork. The semi-dried sweet pork was divided into 3 groups as following: i) control group (no adding green tea extract), ii) adding 100 mg butylated hydroxy toluene (BHT)/kg of meat and iii) adding 200 mg green tea extract/kg of meat. Antioxidant activity (% radical scavenging activity), lipid oxidation (TBARS) and sensory evaluation were carried out. All samples were packed in plastic bags under aerobic condition and stored at room temperature for 4 weeks. Sampling time for TBARS was after treatment at 0, 14 and 28 days. For antioxidant activity, the sampling times were at 0 and 28 days. For sensory panel evaluation, sampling time was performed at 1 day after preparation and stored at room temperature. The results found that the percentages of free radical scavenging activity values in both treated groups were higher than control. The highest value was observed in semi-dried sweet pork adding green tea extract ($p<0.01$). TBARS values in green tea groups were lower than control and the lowest value was found in semi-dried sweet pork adding BHT ($p<0.01$). However, the difference of sensory evaluation was not exhibit among the groups.

Key Words – Plant extract, Lipid oxidation, Semi-dried sweet pork

I. INTRODUCTION

Semi-dried sweet pork is a kind of traditional recipe consumed in Thailand. This product extends the shelf life of pork by sweetening and drying, nevertheless, is also susceptible to oxidative modifications. Lipid oxidation is an important quality deteriorative process resulting in off-odors/flavors in meat and meat products [1]. In recent year, natural extracts become an alternative antioxidant for natural solutions to retard oxidative rancidity [2]. Green tea extract are derived from the tea leaves of *Camellia sinensis* [3]. The main flavonols, catechins, found in green tea are minimise oxidative rancidity and extend the shelf-life of meat products instead of synthetic additives [4]. Tang *et al*. [5] reported that dietary tea catechins showed inhibiting effects of lipid oxidation for 1 year frozen-stored chicken meat and possessed strong scavenging capacity for DPPH free radical. Therefore, the objective of this study was to evaluate the effect of green tea extract and butylated hydroxy toluene (BHT) on antioxidant activity of semi-dried sweet pork during storage at room temperature, using measurement of thiobarbituric acid reactive substances (TBARS), DPPH radical scavenging assay and sensory evaluation.

II. MATERIALS AND METHODS

Preparation of green tea extract

Green tea extract in powder form was obtained from Mahidol University, Thailand. Each 100 mg of green tea powder contained cathechins 12.94 mg (catechins 3.65 mg, epicatechin 3.65 mg, epicatechin gallate 2.31 mg and epigallocatechins gallate 1.82 mg).

Preparation of semi-dried sweet pork samples

The semi-dried sweet pork ingredients were prepared by using food additive as following: sodium chloride, sodium nitrite, soy sauce and sugar. Ground pork was prepared by mixing lean pork ham (70%) and back fat pork (30%), mincing twice using meat grinder before external fat and connective tissue were removed. After all ingredients were mixed, semi-dried sweet pork

was made a shape and dry under the sun for 2 hrs. The product was consequently dried again under hot air oven with air flow for 3 hrs. Semi-dried sweet pork was grilled until the products cook well. Then, the products were stored in plastic bag under aerobic condition at room temperature. These semi-dried sweet pork were divided into 3 groups as following: i) control group (no adding green tea extract), ii) adding 100 mg butylated hydroxyl toluene (BHT)/kg of meat and iii) adding 200 mg green tea extract/kg of meat.

Measurement of lipid oxidation and antioxidant activity

- 1,1-Diphenyl-2-Picrylhydrazyl Radical-Scavenging Assay (DPPH)

The antioxidant activity of green tea extract using DPPH assay expressed as a percentage of radical scavenging activity [6]. DPPH measurements were made on days 0 and 28 of storage.

- 2-Thiobarbituric Acid-Reaction substance (TBARS)

The extent of lipid oxidation was measured by the 2-thiobarbituric acid method (modified from [7]). Results were expressed as 2-thiobarbituric acid reactive substances (TBARS) in mg malondialdehyde (MDA)/kg sample. TBARS values were measured on days 0, 14 and 28 of storage.

Sensory evaluation

A sensory test comprised of 30 panelists. Sensory attributes, including color, odor, taste and overall acceptability, were determined by the 5-point hedonic scale (from 5-like very much to 1-dislike very much). The scale 1-5 represented dislike very much and like very much, respectively. Samples were performed after storage 1 day.

Statistical analysis

Statistical analysis (CRD, ANOVA) was performed using SAS. Differences of means were separated by Duncan's New Multiple Rang Test: DMRT).

III. RESULTS AND DISCUSSION

Antioxidant property and Lipid oxidation stability

Antioxidant activity of semi-dried sweet pork stored in plastic bag at room temperature for 28 days was presented in Table 1. DPPH assay express as percentage of radical scavenging activity indicated that group of green tea extract and BHT were higher ($p<0.01$) than control group. The group of semi-dried sweet pork adding green tea extract displayed the highest value compared to BHT and control groups, respectively, at 0 and 28 days of storage time. While, % free radical scavenging values were decreased throughout the storage period. Green tea extract has shown the strong free radical scavenging ability plus the iron-chelating effects of tea catechins provide a plausible mechanism for antioxidant effects of added tea catechins in the *in vitro* meat system [5]. These results were to Abu-Salem *et al*. [8] found that the addition of green tea extract during luncheon meat processing could enhance quality and provide safer product.

Table 1. 1,1-Diphenyl-2-Picrylhydrazyl Radical-Scavenging Assay (DPPH) of semi-dried sweet pork at 0 and 28 days of storage

Day	Treatment	% radical scavenging
0	Control	23.75^{c}
	Green tea	78.26^{a}
	BHT	41.88^{b}
28	Control	13.40^{c}
	Green tea	63.98^{a}
	BHT	31.35^{b}

^{a,b,c} The means with different superscripts in same column at the same day of storage are significant different ($p<0.01$)

Lipid oxidation activity of semi-dried sweet pork was analyzed after stored for 28 days. TBARS values were significantly reduced ($p<0.01$) in groups with adding BHT and green tea extract compared to control group (Table 2). Similar to Hęś *et al*. [9] reported that the added antioxidant (green tea extract and BHT) could retard lipid oxidation to a significant extent in frozen meat products made from minced pork meat during 180 days of storage time. However, BHT group was the most effective antioxidant follow by green tea

extract. Our results also supported by Lara *et al*. [2] who reported that BHT had higher potency in water soluble than plant extract. Due to the antioxidant active compounds in BHT had dissolved in the lipid matrix of the products, therefore, had decreased oxidation in more direct way. Moreover, lipid oxidation was decreased during 28 days of storage time.

Table 2. 2-Thiobarbituric Acid-Reaction substance (TBARS) of semi-dried sweet pork at 0, 14 and 28 days of storage (mg malondialdehyde/kg meat)

Day	Treatment	TBARS
0	Control	80.88
	Green tea	97.59
	BHT	23.48
14	Control	269.28[a]
	Green tea	158.98[b]
	BHT	48.32[c]
28	Control	278.16[a]
	Green tea	214.25[a]
	BHT	34.80[b]

[a,b,c] The means with different superscripts in same column at the same day of storage are significant different ($p<0.01$)

Sensory analysis

Sensory evaluations of semi-dried sweet pork were shown in Table 3. Addition of green tea extract and BHT did not significantly ($p>0.05$) affect the sensory scores for any of the quality attributes tested. Sensory scores assigned by panelists ranged from 3.09 to 3.82. It was determined that addition of green tea extract and BHT did not adversely affect to the sensory properties of semi-dried sweet pork.

Table 3. Sensory analysis of semi-dried sweet pork at 1 day of storage

sample	Considering characteristic			
	Color	Odor	Taste	Overall
Control	3.79	3.35	3.39	3.51
Green tea	3.10	3.29	3.09	3.10
BHT	3.82	3.65	3.70	3.70

The means in same column are no significant different ($p>0.05$). The scale 1-5 represented dislike very much and like very much, respectively

IV. CONCLUSION

The addition of natural antioxidants and synthetic additive to semi-dried sweet pork shows significant antioxidant activity and lipid oxidation. The eating quality of semi-dried sweet pork was unaffected by green tea extract and BHT. Therefore, it would be advisable to replace BHT by green tea extract to preserve the quality and safety in semi-dried sweet pork product.

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REFERENCES

1. Nissen, L.R., Byrne, D.V., Bertelsen, G. & Skibsted L.H. (2004). The antioxidative activity of plant extracts in cooked pork patties as evaluated by descriptive sensory profiling and chemical analysis. Meat Science 68: 485-495.
2. Lara, M.S., Gutierrez, J.I. & Andrés, A.I. (2011). Evaluation of two natural extracts (*Rosmarinus officinalis* L. and *Mellisa officinalis* L.) as antioxidants in cooked pork patties packed in MAP. Meat Science 88: 481-488.
3. Perumalla, A.V.S. & Hettiarachchy, N.S. (2011). Green tea and grape seed extracts - Potential applications in food safety and quality. Food Res. Inter. 44: 827-839.
4. Henning, S.M., Niu Y., Lee, N.H., Thames, G.D., Minutti, R.R., Wang, H., Go, V.L.W. & Heber, D. (2004). Bioavailability and antioxidant activity of tea flavanols after consumption of green tea, black tea, or a green tea extract supplement. Am. J. Clin. Nutr. 80: 1558-1564.
5. Tang, S.Z., Kerry, J.P., Sheehan, D. & Buckley, D.J. (2002). Antioxidative mechanisms of tea catechins in chicken meat systems. Food Chem. 76: 45-51.
6. Tang, S. Z., Kerry, J. P., Sheehan, D.,Buckley, D. J. & Morrissey, P.A. (2000). Dietary tea catechins and iron-induced lipid oxidation in chicken meat, liver and heart. Meat Sci. 56: 285–290.
7. Castillo, A., Lucia, L. M., Goodson, K. J., Savell, J. W. & Acuff, G. R. (1998). Decontamination of beef carcass surface tissues by steam vacuum alone and combined with hot water and lactic acid sprays. J. Food Prot. 61: 140 – 151.

8. Abu-Salem, F.M., Abou-Arab, E.A., Ibrahim, H.M. & Abou-Arab, A.A. (2011). Effect of adding green tea extract, thyme oil and/or their combination to luncheon roll meat during refrigerate storage. J. American Sci. 7:538-548
9. Hęś, M., Korczak, J. & Gramza, A. (2007). Changes of lipid oxidation degrees and their influence on protein nutritive value of frozen meat products. Pol.J.Food Nutr. Sci. 3: 323-328.