ANTI OXIDANT EFFECT OF TOMATO POWDER IN COOKED PORK SAUSAGES

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Abstract – A commercial tomato powder (TP) was evaluated for antioxidant effectiveness in cured and uncured cooked pork sausages. TBA values, instrumental color evaluation and sensory panel scores were assessed. For uncured sausages, TP at 2% was equally effective as 0.1% butylated hydroxytoluene (BHT) in reducing TBA values. However, TP did not affect the TBA value in cured sausages. Incorporation of 2% TP into sausages produced higher (P<0.05) CIE lab color a* value and lower (P<0.05) L* and b* values. Sensory panels showed significantly high (p<0.05) preference for the color in uncured sausages with addition of 2% TP, while not detect any difference in odor, flavor, taste, juiciness and overall acceptance. However, there were adverse changes in the color and juiciness of cured sausages, even though the odor, flavor, taste and overall acceptance were similar. Therefore, the results suggest that 2% TP is a potential antioxidant and improve color in uncured pork sausages.

Key Words – Tomate powder, lycopene, TBA, Antioxidant

I. INTRODUCTION

Antioxidants are used to minimize the oxidative changes in meat and meat products (Shah et al., 2014). The antioxidants can be of synthetic or natural origin. But the demand for natural antioxidants, especially of plant origin has increased in the recent years due to the growing concern among consumers about these synthetic antioxidants for their potential toxicological effects (Juntachote et al., 2006; Naveena et al., 2008; Nunez de Gonzalez et al., 2008). Thus, recent approaches on using natural antioxidant such as adzuki powder derived from adzuki beans (Jayawardana et al., 2011), anthocyanin-rich colored potato flakes (Jayawardana et al., 2012) and tunic onion powder containing quercetin (Shimada et al., 2011) in cooked sausages showed potential of using plant based natural antioxidants.

Tomato and tomato products are rich in lycopene and as well as other carotenoids such as β-carotene, phytoene, phytofluene and lutein (Calvo, 2008). Since antioxidant effects of these compounds were well known, adding of tomato, tomato products or lycopene to meat could lead to products with health benefits (Shah et al, 2014). Few studies have been reported regarding the use of tomato products or lycopene in meat products. Deda et al. (2007) and Doménech-Asensi et al. (2013) reported on the use of tomato paste in frankfutters and in mortadella respectively. Whereas, Eyiler and Oztan (2011) and Kim et al, (2011) reported on the use of tomato powder in frankfurters and low fat pork sausages respectively. Furthermore, Calvo et al. (2008) studied the effect of lycopene obtain from tomato peel on the product quality of dry fermented sausages.

Hence, the aim of this study was to evaluate the antioxidant efficacies of tomato powder and determine its effect on color and sensory attributes in both cured (sodium nitrite added) and uncured (without sodium nitrite) cooked pork sausages.

II. MATERIALS AND METHODS

Preparation of pork sausages for testing the antioxidant efficacy of TP

Pork sausages were prepared for testing the antioxidant efficacy of TP by measuring thiobarbituric acid (TBA) value. Uncured pork sausages were prepared by minced lean meat of 3 mm in diameter mixed with NaCl (2% w/w), lard (20% w/w) and ice (20% w/w). To evaluate the antioxidant efficacies of TP, different concentrations of TP (0.5%, 1%, 1.5%, 2%) and 0.1% butylated hydroxytoluene (BHT), a synthetic antioxidant were added to the aforementioned formula. Control containing no added antioxidants was also prepared. Then all the samples were ground using a silent cutter. Finally, samples were

manually stuffed into the collagen casings (# 300, Nippi Inc., Japan) and cooked for 30 min at 63 °C core temperature. To prepare cured pork sausages, 0.008% (w/w) sodium nitrite was additionally added to the meat batter which was used to prepare uncured sausages replacing the equivalent amount of ice. To evaluate the antioxidant efficacies of TP in cured pork sausages, 2% TP added sausages were compared with its control (0% TP).

Pork sausages for sensory evaluation & instrumental color assessment

Pork sausages prepared for the sensory evaluation and instrumental color assessment were also formulated using the aforementioned procedure in section 2.1 However, before grinding the meat mixtures, to both cured (sodium nitrite 0.008% (w/w) added) and uncured (without sodium nitrite) mixers, the following ingredients were added: 0.5% sugar, 0.6% pepper, 0.1% sage, 0.1% nutmeg, 0.1% garlic powder and 0.05% sodium ascorbate. Both uncured and cured samples added with 2% TP were compared with its respective controls (0% TP) in sensory evolution and instrumental color evaluation.

Analysis of 2-thiobarbituric acid (TBA) value

The effect of TP was evaluated on the oxidative stability of cooked pork sausages, during storage at 37º C, by measuring thiobarbituric acid (TBA) values. Measurements were taken on the 0, 1st, 3rd and 5th day of storage. Sausage sample (0.2 g) was taken and TBA values were extracted for 1 hr at 4 °C with 4.25 ml of TBA solution containing 0.28% TBA, 0.009% BHT, 0.4% SDS, 1.2M ammonium acetate buffer, pH3.5, and the extract was heated in a boiling water bath (90 °C) for 60 min. After cooling, 1 ml of distilled water and 5 ml of n-butyl alcohol : pyridine (15:1) were added to the extracts and mixed using vortex mixer. The mixtures were centrifuged at 3,000 rpm for 10 min at the room temperature. After centrifugation, upper phase was pipetted into test tubes. The absorbance of sample was read against the appropriate blank at 538 nm. The amounts of TBARS were expressed as μmol of malondealdehyde (MDA) per kg of sausage.

Instrumental color measurement

Effect of the TP on color properties (L*, a*, b*) of cooked pork sausages was evaluated by Chroma Meter Minolta CM-2600d spectrophotometer (Minolta, Japan) throughout the 5 days storage period at 37ºC. The white standard was a piece of tile of known reflectance; the light source D65 and the standard observer angle 10° were used.

Sensory analysis

The sensory evaluation was performed by a sensory panel composed of 70 (for uncured samples) members and 72 members (for cured samples) by using paired test for color, flavor, taste and texture for cooked pork uncured sausages and cured sausages. Sausages were pre-warmed before serving and water was served for rinsing the mouth between samples.

Statistical analysis

Five replications of the study were performed and measurements of all parameters were made in duplicate All data were analyzed by analysis of variance with Turkey-Kramer test and student t-test (IBM SPSS Statistics version 22.0, IBM co., 2013), with $P<0.05$ as the minimum acceptable probability for differences between means.

III. RESULTS AND DISCUSSION

The effect of different concentrations of TP on TBA values in cooked uncured pork sausages during the 5 days storage at 37º C is shown in Figure 1. Five concentrations (0.5%, 1%, 1.5% and 2%) of TP and 0.1% BHT significantly ($P < 0.05$) reduced the TBA values compared with the control (0 % TP) throughout the storage period. Furthermore, in the bar graphs prepared using 5th day data of different TP concentrations (Figure 1b), 2% TP showed similar antioxidative capacity as of 0.1 % BHT indicating very strong antioxidative effect.

Observation of TBA values of cooked cured pork sausages prepared with 0.008% sodium nitrite is shown in Figure 2. When sodium nitrite is presence, addition of 2% TP not significantly ($P<0.05$) reduced the TBA values.

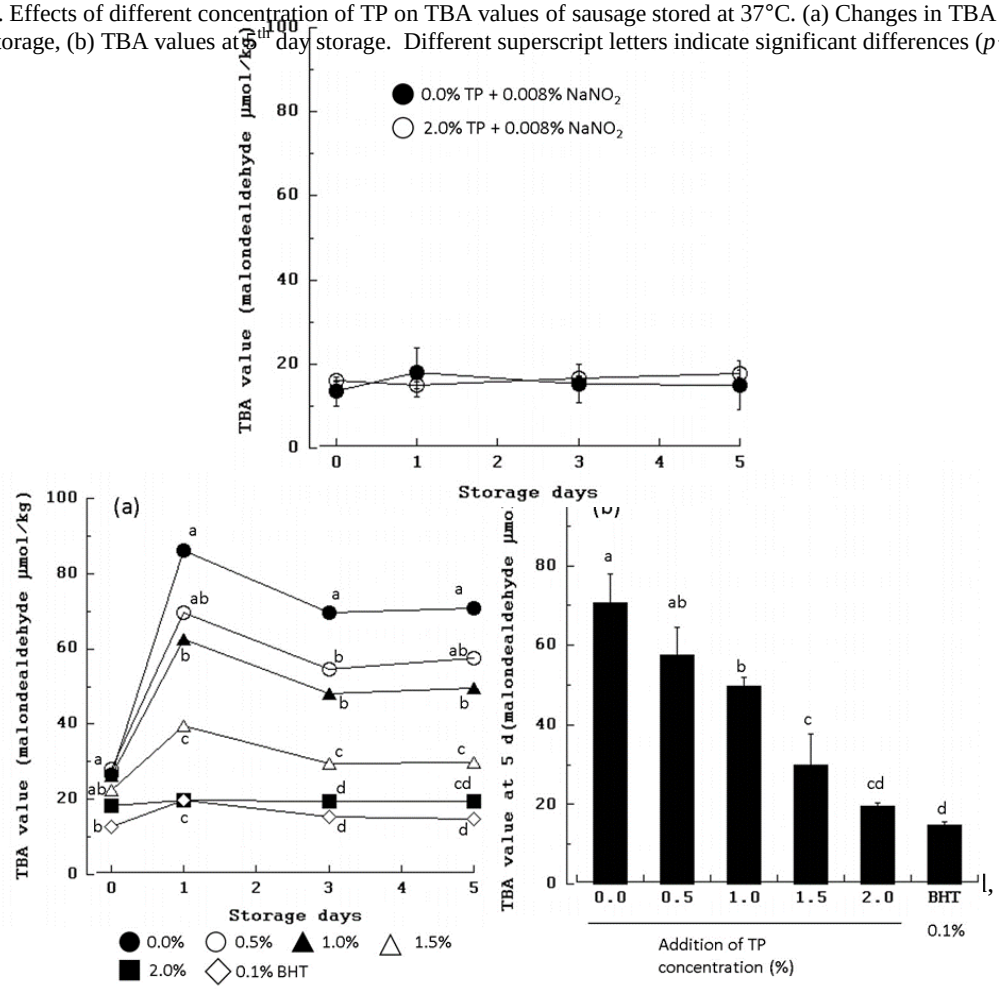
Addition of TP tend to decrease L* value, while a* value and b* value showed increase (data not

shown). Sensory panels showed significantly high ($p<0.05$) preference for the color in uncured sausages with addition of 2% TP, while not detect any difference in odor, flavor, taste, juiciness and overall acceptance (Figure 3a). However, there were adverse changes in the color and juiciness of cured sausages, even though the odor, flavor, taste and overall acceptance were similar (Figure 3b).

Figure 2. Changes in TBA content of sodium nitrite added cooked pork sausages during storage periods.

Closed circles show 0.0%TP + 0.008% $NaNO_2$, Open circles show 2.0% TP + 0.008% $NaNO_2$.
* indicates significant difference ($p<0.05$).

Figure 1. Effects of different concentration of TP on TBA values of sausage stored at 37°C. (a) Changes in TBA values during storage, (b) TBA values at 5th day storage. Different superscript letters indicate significant differences ($p<0.05$).



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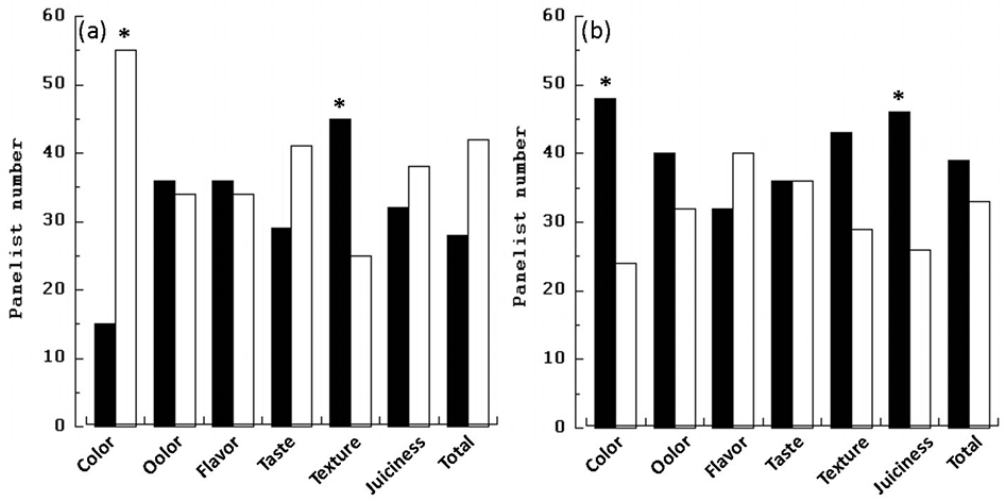

Figure 3. Effects of addition of TP on Sensory attributes. (a) Sensory analysis by the paired tests in the uncured sausages, (b) Sensory analysis by the paired tests in the cured sausages. Black color columns show panelist number for sausages without TP. White color columns show panelist number for sausages added with 2%TP. * shows significant differences ($p<0.05$).

IV. CONCLUSION

This study concluded that the addition of 2 % TP provide an antioxidant benefits to the cooked uncured pork sausages stored at 37º C, which is comparable with the 0.1% of synthetic antioxidant BHT. Thus, the TP could be used as a natural food additive to extend the shelf life of meat products, and may attract the consumers who prefer natural food additives compare to those of synthetic origin.

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