Changes in Quality Characteristics of Fresh Pork Patties Added with Tomato Powder during Storage

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Abstract
This study was carried out to determine the effects of olive oil prepared tomato powder (OPTP) used as lycopene source on fresh pork patties. OPTP was not added (0%; C), or was added at 0.25% (T1), 0.5% (T2), 0.75% (T3) and 1.0% (T4) in a basic pork patty formula and patties were stored for 7 days at 5°C. pH values of T3 and T4 were lower (p<0.05) than those of control until storage day 3. However, pH values of treated samples were dramatically increased (p<0.05) after 7 d of storage. Cooking loss values of treatments were lower (p<0.05) than those of control at day 1 of storage. Thiobarbituric acid reacting substances values were lower (p<0.05) in all treatments than in untreated samples during storage. All treated samples had lower values (p<0.05) for lightness (L*) but significantly higher values (p<0.05) for redness (a*) and yellowness (b*) than the untreated samples during storage. Total plate counts of T4 were lower (p<0.05) than others during storage. In sensory evaluation, the scores of color, aroma and overall acceptability in T3 and T4 scored higher (p<0.05) than those of control at days 1 and 3 of storage, however, statistical significance was not found (p>0.05) among the samples after 7 days of storage. In conclusion, tomato powder-treated groups were significantly higher in redness (a*) and yellowness (b*), and lipid oxidation was inhibited, as compared with control during storage. Therefore, as a natural additive, tomato powder could be used to extend the self-life of meat products, providing the consumer with food containing natural additives, which might be seen more healthful than those of synthetic origin.

Key words: tomato powder, lycopene, non-cooked pork patty, meat quality

Introduction

In these days consumers have demanded meat products that are safe, nutritious, convenient, rich in variety, attractive (in appearance, texture, odor, and taste) and innovative. The consumer preference for naturally derived colorants is associated with their image of being healthy and of good quality. In addition, some synthetic colorants are considered to be responsible for allergenic and intolerance reactions (Osterlie and Lerfall, 2005). This stimulates interest in manufacturing meat products by using new technologies and formulations, using different types of meat and reducing levels of sodium or potassium nitrite, phosphate, salt and fat, all of which lead to beneficial effects on health (Arun et al., 2010; Lin and Lin, 2002).

Tomatoes are an integral part of the human diet worldwide. Although they are frequently consumed fresh, over 80% of tomato consumption comes from processed products such as tomato juice, paste, puree, ketchup and sauce (Gould, 1992). Recent studies have indicated the potential health benefits of a diet rich in tomatoes and tomato products (Tapiero et al., 2004). Tomato and tomato products are the major sources of lycopene and are considered to be important contributors of carotenoids in human diet (Goula and Adamopoulos, 2005; Adamopoulos, 2005; Tapiero et al., 2004). Tomato and tomato products are rich in lycopene and other carotenoids such as β-carotene, phytoene, phytofluene and lutein (Choski and Joshi, 2007; Kavanaugh et al., 2007). The ability of lycopene to act as a potent antioxidant is thought to be responsible for protecting cells against oxidative damage and thereby decreasing the risk of chronic diseases (Kavanaugh et al., 2007; Omoni and Aluko, 2005). Adding tomato, tomato products or lycopene to meat could lead to products with health benefits. However, few studies have been reported regarding the use of tomato products or lycopene in meat and meat products (Candogan, 2002; Deda et al., 2007; Osterlie...
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and Lerfall, 2005; Sánchez-Escalante et al., 2003; Yilmaz et al., 2002). The present study addresses the utilization of different level of tomato powder as antioxidant treatments in fresh pork patties. Our objective was to evaluate the effectiveness of different levels of tomato powder for inhibiting lipid oxidation and color stability as well as microbial growth in fresh pork patties packaged with oxygen-permeable bag during refrigerated storage at 5°C for 7 d.

Materials and Methods

Preparation of dried tomato powder

Fresh tomato harvested in August 2007 was obtained from an agricultural products wholesale market in Jinju, Korea. After washing and dicing, hot-air drying method was used. Tomato paste (5 kg) was mixed with olive oil (140 mL), and dried at 80°C for 2 h and 60°C for 72 h using a hot-air drying oven (DMC-122SP, Daeil Eng. Co., Korea) to 3-5% moisture content. The dried tomato was then pulverized using a blender (3030, Hsign Feng Enterprise Factory, Taiwan) and sieved through a No. 40 stainless sieve (40 mesh). The resulting tomato powder prepared with olive oil (TPPO) were then sealed and kept at -40°C. The powder prepared by this way had color values in lightness (CIE L*) 46.24, redness (CIE a*) 8.26 and yellowness (CIE b*) 6.26.

Meat patty manufacture

Fresh pork loin and backfat were obtained from a local meat market. Fresh pork meats were trimmed of separable fat to provide very lean meats. The lean meat and the pork backfat were separately ground through a 10 mm plate and then through a 5 mm plate. Ground meat was thoroughly mixed with salt, seasoning, ice and ground back fat using a mixer (5K5SS, KitchenAid®, USA). Used seasonings and additives were obtained from MSC Co., Ltd. (Seongnam, Korea). Pork meat patties were formulated according to the experimental design with a base formula containing ground pork, ground fat, salt, pepper, ice as well as four levels of TPPO [0% (C), 0.25% (T1), 0.25% (T2), 0.5% (T3) and 0.75% (T4)] (Table 1). The selected adding concentrations of TPPO were decided mainly by preliminary experiments of sensory evaluation. All treatments, about 5 kg each, were replicated three times from separate meat sources at three different time periods. Pork meat patties were hand linked at 2 cm thickness, and weighed approximate 50 g. The fresh pork patties were packed with a thin polyethylene film of high oxygen permeability (equal to aerobic package) and were stored in the dark room at 5°C (±1°C) until subsequent analysis.

pH value

The pH values were measured by blending 10 g of samples with 90 mL distilled water for 30 s (T25B, IKA, Malaysia). Readings were taken with a pH meter (8603, Metrohm, Switzerland).

Cooking loss

The packages were heated in a water bath at 75°C for 1 h and then cooled at room temperature for 30 min. The cooking-loss percentage was determined by the sample weight differences between before and after cooking.

TBARS

The 2-thiobarbituric acid reactive substances (TBARS) test according to Tarladgis et al. (1960) was used to determine the extent of oxidative rancidity. A 5 g sample was homogenized in a 50 mL centrifuge tube with a 50 uL of BHA (7.2% in ethanol) and 15 mL of distilled water by using a homogenizer (T-25B, IKA, Malaysia). Two mL of the homogenate was mixed with 4 mL of a thiobarbituric acid (TBA/trichloroacetic acid (TCA) solution (20 mM TBA in 15% TCA), heated at 90°C in water bath. After heating the samples were cooled in ice and centrifuged for 15 min at 2,000 rpm by using a centrifuge (UNION 5KR, Hanil Science Industrial, Korea). The absorbance of the supernant was measured at 532 nm by using a spectrophotometer (Spectronic Genesys 5, Thermo Fisher Scientific, USA). The concentration (mg MA (malonaldehyde))/kg sample on the basis of wet weight) was calculated using a standard curve.

Volatile basic nitrogen (VBN) values

A micro-diffusion method described by Pearson (1968)