Avocado by-products as inhibitors of color deterioration and lipid and protein oxidation in raw porcine patties subjected to chilled storage

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ABSTRACT

Processing of avocados generates an important amount of by-products such as peels and seeds that are rich in bioactive substances with proven radical suppressing activities. The objective of this study was to evaluate the effectiveness of peel and seed extracts from two avocado varieties—'Hass' and 'Fuerte'—as inhibitors of lipid and protein oxidation and color deterioration of raw porcine patties during chilled storage (4 °C/15 days). Avocado extracts significantly (p<0.05) reduced the loss of redness and the increase of lightness during storage of porcine patties. 'Fuerte' extracts were more efficient at inhibiting discoloration of chilled patties than 'Hass' extracts. Patties treated with avocado extracts had significantly lower amounts of TBA-RS than control ones throughout the storage. 'Hass' avocado extracts significantly inhibited the formation of protein carbonyls in chilled patties at day 15. The present results highlight the potential usage of extracts from avocado by-products as ingredients for the production of muscle foods with enhanced quality traits.

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1. Introduction

The oxidation of lipids and proteins is a major cause of meat deterioration (Morrissey, Sheehy, Galvin, Kerry, & Buckley, 1998). Lipid oxidation promotes meat discoloration through the oxidation of myoglobin and leads to the formation of low molecular weight compounds which impart rancid odors and off-flavors (Mercier, Gatellier, & Renerre, 2004; Shahidi, 1998). In relation to protein oxidation, the nature of the oxidation products formed is highly dependent on the amino acids involved and how the oxidation process is initiated (Lund, Heinonen, Baron, & Estévez, 2011). The side-chains of some particular amino acids such as arginine, lysine and proline, are oxidized through metal-catalyzed reactions into carbonyl residues (Davies & Dean, 2003; Garrison, 1987; Stadtmann & Berlett, 1988). Lipid and protein oxidation have been reported to occur concurrently in meat systems, although relatively little is known about the repercussions of the latter on the quality of meat products (Decker, Xiong, Calvert, Crum, & Blanchard, 1993; Estévez, Ventanas, & Cava, 2006). The oxidation of myofibrillar proteins might play a role in the loss of enzyme activity, protein solubility and formation of protein complexes and non-enzymatic browning products and could be linked to meat tenderness (Lund, Lametsch, Hviid, Jensen, & Skibsted, 2007a; Mercier et al., 2004). The occurrence of protein oxidation during chill storage of raw meat products and the interaction between oxidizing proteins with other food components such as lipids and myoglobin, require further research.

The use of antioxidant compounds is an effective way to minimize or prevent lipid oxidation and hence, retard the formation of toxic oxidation products, maintain nutritional and sensory quality and extend the shelf life of muscle foods (Pokorny, Yanishlieva, & Gordon, 2001). Antioxidants from natural resources are of increasing interest for consumers and meat technologists owing to their health implications and functionality. The benefits of plant phenolics and other natural antioxidants go beyond their efficacy against lipid oxidation as they are believed to enhance the quality and nutritional value of foods (Soong & Barlow, 2004; Wu et al., 2004). Crude extracts of fruits (De Oliveira et al., 2009; Ganhão, Estévez, Kylli, Heinonen, & Morcuende, 2010), herbs (Wojdylo, oszmianski, & Czemerky, 2007; Yoo, Lee, Lee, Moon, & Lee, 2008), vegetables (Ismail, Marjan & Foong, 2004), cereals (Ragae, Abde-Aal, & Noaman, 2006), residual sources (Moure et al., 2001) and other phenolic-rich plant materials have been shown to display remarkable antioxidant potential. Little is known, however, about the effectiveness of these antioxidants against protein oxidation in meat products. Some authors have reported contradictory effects of natural antioxidants such as ascorbic acid, tocopherols and phenolic compounds on the oxidative stability of muscle proteins (Estévez & Cava, 2006; Estévez & Heinonen, 2010; Lund, Hviid, & Skibsted, 2007b).