Evaluating antioxidant properties of pulp and skin of fig extracts and application in canola oil as replacing synthetic antioxidant

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Introduction: Lipid oxidation is a complex series of reactions that occurs during processing, storage and final preparation of foods containing lipids (Bera et al., 2006). Among the various methods of protection against oxidation, specific additives are used which are antioxidants (Pokorny et al., 2006). Polyphenols are natural antioxidants that possess characteristic properties, such as free-radical scavenging and inhibition of oxidizing processes in the body. For using of phenolic compound, they must be extracted from plant material. Traditional methods of extraction are labor-intensive, time consuming, and require large volumes of solvent (Wang and Weller, 2006). In recent years, ultrasound-assisted extraction (UAE) has become an effective method for edible oils and fats from natural product extraction. UAE is an inexpensive, simple and efficient alternative to conventional extraction techniques (Chen et al., 2010). The mechanism of UAE is attributed to mechanical and cavitation efficacies which can result in disruption of cell wall, particle size reduction, and enhanced mass transfer across cell membrane (Wang, Wu, Chen, Yue, Liang, & Wu, 2013). Figs are an excellent source of phenolic compounds and some studies have described the presence of several phenolic compounds in this species (Solomon et al., 2006; Teixeira et al., 2006; Vaya and Mahmood, 2006). However, according to our knowledge, there are no studies about the detailed investigation of different parts of the fig and evaluation of its oxidative stability. Therefore, the objective of this study was to evaluate antioxidant activity of pulp and skin of two varieties of fig (Siyah and Sabz) and its application as natural antioxidant in canola oil.

Material and methods: Fig fruit (F. carica L.) from two selected commercial varieties: Siyah and Sabz were collected from Gorgan, Iran in September 2014. Canola oil was purchased from Alia Golestan Company (Kordkooy, Iran). All other chemicals used in this study were of analytical grade and were purchased from chemical suppliers such as Merck and Sigma-Aldrich Chemical Companies.

The figs were weighed and immediately peeled. The pulp was cut and made into flat sheets. Thereafter, the pulp and skin of each fruit were shade-dried for 5 days followed by drying at 60 °C in an oven for 24 hours to ensure complete drying (Memmert 100-800, Germany). The samples were then milled and sieved. Samples obtained were kept in polyethylene bags.

Dried fig powders were mixed with ethanol (1:10), then placed in ultrasonic bath, and then sonicated at 37 kHz for 20 min at 40 °C by Elma Transsonic ultrasonic bath model 690/H (Cottbus, Germany). The extract was filtered and subsequently evaporated at 40 °C in an oven. The concentrated extracts were stored at -18° C until further analyses (EsmaeilzadehKenari et al., 2014). Extracts were used in concentrations of 0.5, 1, 1.5, 2, 2.5 and 3 mg/ml.

Phenolic compounds and flavonoids were measured by Folincio-calteu and aluminum chloride, respectively. The antioxidant activity of the extracts was evaluated using DPPH and reducing power tests. Then we assessed the efficiency of extract of skin fig of Siyah variety at 1 mg/ml the oxidative stability using Peroxide, thiobarbituric acid, conjugate di en, acid value, Oxidativestabilityindex and colorindex in canola oil during thermal conditions (180 °C, 24 hours) compared with Synthetic antioxidants of TBHQ.

Results and discussion: The fig extracts contained different antioxidative fractions which were able to inhibit lipid oxidation effectively, by different mechanisms of action. Antioxidant activity of Siyah variety extract was higher than that of Sabz variety extract; furthermore, skin extracts were found to render higher antioxidant activity than pulp extracts. The stabilization effect of Siyah fig skin extract on canola oil (using peroxide, thiobarbituric acid, conjugate di en, acid values, oxidative stability index and color index) was comparable

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with the synthetic antioxidant (TBHQ). Therefore, skin of Siyah fig can be used as a potent source of natural antioxidant in food system.

**Key words:** Fig, pulp, Skin, Ultrasound, Antioxidant activity, Oxidative stability