ANTIOXIDANT ACTIVITY OF GRAPE SEED EXTRACT IN GROUND PORK MEAT

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Introduction

Lipid oxidation is one of the major factors in the deterioration of meat and meat products during storage and processing, causing changes in the functional and sensory characteristics, and decreasing the shelf life. Synthetic antioxidants, such as BHT, BHA, and propyl gallate, have been utilised to extend the shelf life of a product by retarding the development of rancidity. However, the use of synthetic antioxidants in food has been under scrutiny for toxicological reasons (Madhavi *et al.*, 1995), and thus the interest in natural antioxidants has been steadily increasing. The antioxidant and radical scavenging activities of a large number of polyphenolic compounds, isolated from plants, have been studied by various authors (Bravo, 1998; Robards, 2003; Moure *et al.*, 2001; Pokorny *et al.*, 2001). As the grape seed extract (GSE) contains a lot of polyphenols, it is considered as an excellent natural antioxidant and is used as a health promoting product.

GSE has been evaluated for its antioxidant effect on a few meat types. The inhibition of the development of thiobarbituric acid reactive substances (TBARS) in dark poultry meat with pre- and post-mortem use of GSE has been published (Lau and King, 2003). Mielnik *et al.*, (2006) have supplemented ground turkey meat with GSE before processing and it has been proven that the addition of GSE improved the lipid stability in the cooked turkey meat stored cold. The aim of this research was to determine the possible protective effect of GSE, as a natural antioxidant, on ground pork during refrigerated storage. The development of the oxidation process during storage was monitored by the TBARS values.

Materials and Methods

The pork meat, obtained 24 h *post mortem* from a commercial processing plant, was minced in an industrial meat grinder and transported to the laboratory in plastic bags in a hand-held refrigerator.

GSE was characterised using spectrophotometric methods for its total phenolic and flavan-3-ols content and the radical scavenging activity on DPPH˙. The amount of total soluble polyphenols in the GSE was determined spectrophotometrically according to the Folin-Ciocalteau method (Singleton *et al.*, 1999). Gallic acid was employed as a calibration standard. The amount of total flavan-3-ols was assayed colorimetrically by the vanillin method using catechin as a standard (Sun *et al.*, 1998; Nakamura *et al.*, 2003). The antioxidant activity of the GSE was determined as the measure of radical scavenging using DPPH˙, measured by the spectrophotometric method. The value of the efficient concentration (EC_{50}), defined as the amount of the antioxidant necessary to decrease the initial free radical concentration by 50 %, was calculated for the GSE (Espin *et al.*, 2000).

The GSE was dissolved in sterile water and the following final concentrations were prepared: 0.01; 0.1; 0.5 and 1.0 % (w GSE / w of pork meat). The ground pork was divided into portions and each portion was mixed with the 5 % (w/w) antioxidant solution using a hand-held utensil, according to the following formulation: control (no antioxidant, 5 %, w/w, sterile water was added); 0.01 % GSE; 0.1 % GSE; 0.5 % GSE; 1.0 % GSE and 0.01 % BHA (5 %, w/w, solution of 0.01 % BHA was prepared in oil).

The patties (50 g each) formed from each portion of either water, or BHA or GSE supplemented ground pork were placed in polyethylene bags and stored in a refrigerator at +2° ± 0.5° C. The experiment lasted for 11 days. The determination of TBARS was performed according to the method of Botsoglou *et al.*, (1994). TBARS values were determined on the 1st, 4th, 6th, 7th, 9th, 10th and 11th day of storage. All determinations were made in triplicate and average values were reported.

Results and Discussion

The GSE used in this experiment contains 95.2 % total soluble polyphenols determined according to the Folin-Ciocalteau method. The total flavan-3-ols, assayed by the vanillin method, showed that 99.5 % of GSE contained flavan-3-ols. The investigation showed that the antioxidant activity increased while increasing the concentration of GSE. It was confirmed that the GSE influenced DPPH˙ depending on the concentration of the given extract. The value of EC_{50} obtained for the DPPH˙, determined spectrophotometrically, was 0.8627 mg GSE/mg DPPH˙.

The ground pork used in this experiment contained 5.32 % of total fats. The TBARS values represent the content of the secondary lipid oxidation products, mainly aldehydes, which contribute to off-flavours in the oxidised meat. Malondyaldehyde (MDA), a major degradation product of lipid peroxides, was used as a marker for assessing the extent of lipid peroxidation. The TBARS value is expressed as MDA content (ppb). The effect of the BHA and GSE antioxidants on TBARS value of the ground pork patties over 11 days of the refrigerated storage is shown in Figure 1.

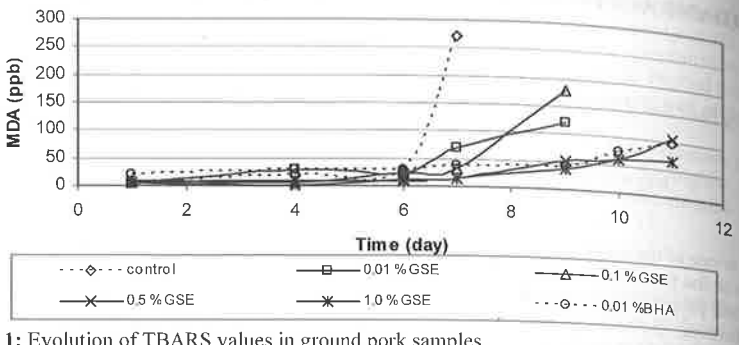

Figure 1: Evolution of TBARS values in ground pork samples.

During the first 6 days of the experiment MDA content in all samples was low and showed poor increase. On the 7th day of the experiment MDA content of the control sample reached 270 ppb, while MDA content of all supplemented samples maintained the moderate increase, except for the sample containing 0.01 % GSE (69 ppb). On the 9th and 10th day of the experiment the MDA content in the samples with 0.01 % and 0.1 % GSE were much higher than in the samples with 0.5 %, 1.0 % GSE and 0.01 % BHA. On the 11th day of the experiment the samples supplemented with 0.5 % GSE and 0.01 % BHA reached 108 and 99 ppb of MDA, respectively, while the sample with 1.0 % GSE contained 67 ppb of MDA.

Conclusions

The ability of the antioxidants examined in retarding lipid oxidation in the ground pork patties throughout the refrigerated storage was in the following order: 1.0 % GSE > 0.5% GSE = 0.01 % BHA > 0.1 % GSE > 0.01% GSE > control. It is evident that the addition of GSE exhibits antioxidant properties and extends the shelf life of ground pork.

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