NATURAL ANTIOXIDANTS FROM CANOLA MEAL

F. SHAHIDI, U.N. WANASUNDARA, R. AMAROWICZ

Department of Biochemistry, Memorial University of Newfoundland, St. John's, NF, Canada, A1B 3X9

M. NACZK

Department of Nutrition and Consumer Studies, St. Francis Xavier University, Antigonish, NS, Canada, B2G 1C0

ABSTRACT

Ethanolic extracts of canola meal were prepared and after removal of solvent, tested in meat, canola oil, and a β-carotene/linoleate model system for evaluation of their antioxidant activity. Crude extracts were further separated into several fractions by column chromatography and antioxidant activity of each fraction was evaluated in a β-carotene/linoleate model system. Oxidative stability of lipid-containing systems were evaluated using both the standard and a novel NMR methodology.

INTRODUCTION

Antioxidants are major ingredients that protect food quality by retarding oxidation. Although the use of synthetic antioxidants is commonplace, there is a general desire to replace synthetic food additives with natural alternatives (Howell, 1986). Sources of natural antioxidants include phenolics that occur in different parts of plants (Pratt and Hudson, 1990).

Canola meal has been reported to contain 1-2% phenolic compounds (Shahidi and Naczk, 1992). Phenolics in canola meal adversely affect its nutritional and sensory properties (Clandinin and Robblee, 1981), thus their removal would improve the quality of meal and provide raw material to retard oxidation of food lipids. This paper reports isolation, fractionation and application of compounds responsible for antioxidative activity of ethanolic extracts of canola meal.

EXPERIMENTAL

Preparation of canola extract and fractionation

Defatted canola meal was extracted with 95% ethanol. The crude extract was dried under vacuum at 40°C. The extract was then fractionated using a Sephadex LH-20 column. Seven fractions were separated based on the UV absorbance of phenolics at 280 and 725 nm before and after color development (Figure 1). Presence of sugars was monitored based on their absorbance at 490 nm after color development. The total content of phenolics as sinapic acid equivalents in mg/g in each fraction was:

I (68), II (22), III (23), IV (34), V (194), VI (119), VII (96). The relative content of phenolics in fractions V to VII was 4.4, 3.5 and 5.1% of the total amount.

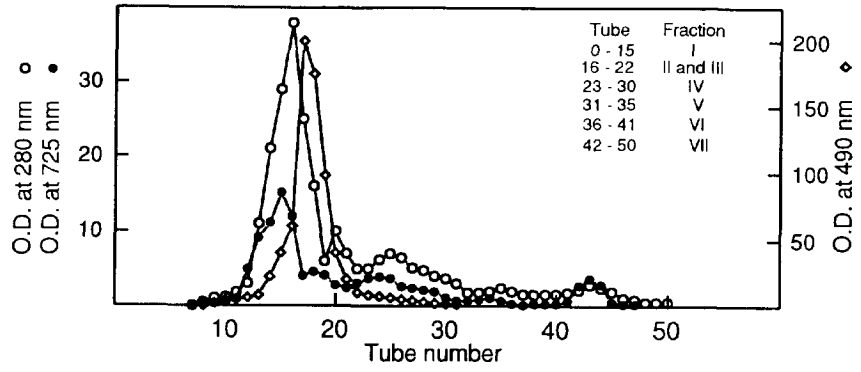

Figure 1. Eluates after Sephadex LH-20 column chromatography.

Antioxidant Activity

Addition of canola meal at 0.5 - 5.0% level to meat inhibited lipid oxidation, as examined by the 2-thiobarbituric acid (TBA) test, by 73 - 97% after heat processing. However, the crude ethanolic extract was much less effective when added at levels equivalent to 0.5 and 1.0% of the meal to meat model system as it inhibited oxidation by 19 and 27%, respectively. Therefore, other components in canola meal may also play an important role in controlling lipid oxidation in meat.

The crude canola extract was added at 100 - 1000 ppm level to canola oil and the oxidation state of the samples was monitored by a number of standard methods and NMR technique. Results on the use of the 2-thiobarbituric acid (TBA) methodology under Schaal oven test conditions at 65°C are reported here. The effect of addition of the extract at > 200 ppm to refined, bleached canola oil was better than that of 200 ppm of butylated hydroxyanisole (BHA) or butylated hydroxytoluene (BHT) and was also comparable to that of BHA/BHT/monoglyceride citrate (MGC) at 250 ppm level (Figure 2). Thus, crude canola extract possesses good antioxidant properties when used to stabilize canola oil. No visible color or perceivable odor or taste were imported to treated samples.

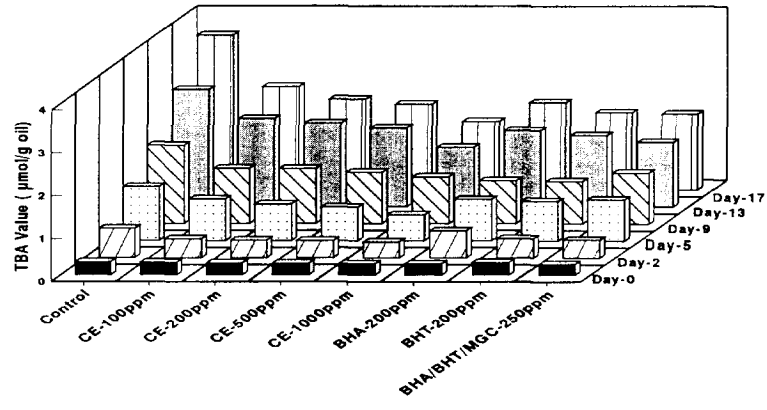

Figure 2. Effect of canola extract (CE) on TBA values of treated canola oils.

From crude canola extract, the antioxidant activity of each of the seven isolated fractions in a β-carotene/linoleate model system is shown in Figure 3. Fraction IV which contributed 14.6% to the total weight of the crude extract exhibited strongest antioxidant effect in preventing the bleaching of β-carotene, but it contained only 34.0 mg phenolics per gram of crude extract. Thus molecular structure of phenolics isolated may have an important effect on their antioxidant activity. Fractions II, V and VI showed comparatively good antioxidant effects, but fractions I and III were only marginally effective.

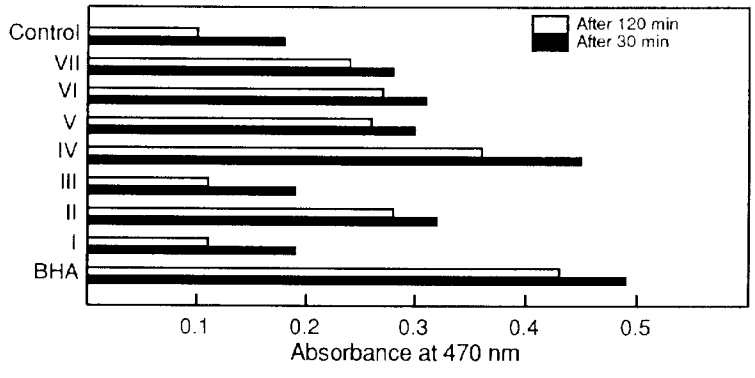

Figure 3. Antioxidant activity of fractions of canola extract in a model system.

While crude canola extract exhibited a higher antioxidant activity than BHA and BHT in canola oil (Wanasundara and Shahidi, 1994), all isolated fractions showed a lower antioxidant activity than BHA in the β-carotene/linoleate model system. Possible synergism of phenolics with one another as well as with other components present in the crude extract may be implicated.

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