Progress Report

Value Added Research in Canola – Evaluation of Anti-Oxidant Activity, Food Efficacy and Food Functionality of Canola Products.

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Significant progress was made in this project. Objectives for the study included the determination of canola phenolic content and measurement of its functionality (antioxidant activity) in food systems. Further objectives included the isolation of bioactive canola components for use in enhancing the shelf life of canola oils. We are also pursuing new information that indicates that antioxidant active is imparted by roasting of canola prior to oil extraction (please see abstract at the end of this report).

Demonstration of the effectiveness of "phenolic spiking" of commercial oils was also done by measurement of reduction of rancidity. Rancidity was judged by measurement of Peroxide Value. the two most important chemical reactions that occur in food systems are lipid oxidation and non-enzymatic browning. This lab exercise focused attention on the former reaction. Lipid oxidation, which is also called auto-oxidation, occurs in lipid material by way of a free-radical mechanism. After an induction period, hydrogen peroxides, or primary products, are formed. Ultimately these peroxides break down, and secondary products, e.g., aldehydes, ketones, organic acids, and hydrocarbons, are formed .The peroxide value (PV) test, which is one of the most common tests used to evaluate the extent of lipid oxidation, is based on measuring peroxides.

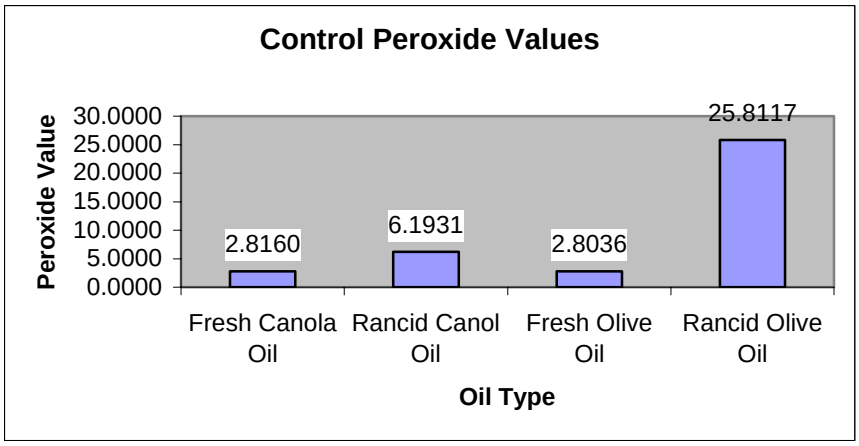
Our aim was to impart antioxidant activity to vegetable oils (canola, oil, olive oil) using extracts obtained from defatted Canola flour. The literature revealed that methanol or ethanol extracts of canola flour selectively solubilize phenolic bioactive compounds that can be measured and shown to retain antioxidative properties. We extracted "phenolics" from a defatted canola meal (5g) and used this extract (50ml) to spike vegetable oils with calibrated doses to determine reduction of rancidity or enhanced shelf stability. Figure 1 provides data on the shelf stability of spiked oils, Spiked oils were also measured over protracted time intervals (3 months) to determine shelf stability. A Peroxide Value test was chosen as an indicator of shelf stability (Method Ja 8-87, AOCS Official Method). A high peroxide value number shows high rancidity. In-house testing showed PV of 5.0 for fresh commercial oils and a PV of 61.8 for highly rancid commercial soybean oils. This range provides a basis of ranking the degree of rancidity. Fresh canola oils had a PV of 2.8 while older canola oils (3 months) showed a PV of 6.2. Canola oil spiked with "phenolic extracts" showed a PV of 2.9 to 3.8 even after storage at room temperature for 12 weeks (3 months). This range is within the acceptable PVs for consumers. Anti-oxidative activity of pure phenolic standards appear to be curvilinear. That is to say, they increase in activity and then plateau even with increasing concentration of the standard. We are attempting to find the optimal "phenolic" dose without imparting detrimental color and taste to the canola oil. The anti-oxidative effect of pure standards tapers off at higher doses (figure 2).

Shelf life and enhanced antioxidant activity studies will provide for comparisons against other commercial man-made antioxidants that are not viewed as health promoters.

Future work that remains to be accomplished contingent on continued funding include sensory testing of canola flours using trained panels to determine taste thresholds for astringence. Trained and untrained panels will also be used in evaluating oils spiked with low levels of ethanolic canola flour extracts. We would like to develop a food or food ingredient from canola that incorporates either the canola flour or de-fatted canola flour Testing will be done with food products already familiar to the American public.

A second set of experiments involving a feeding study of rats will be done in 2006. These studies will reveal the tumor fighting abilities of canola oil constituents. Sixty kilograms of conola seed are being acquired for comparison of roasted and un-roasted seeds in tumor prevention in experimental animals. Details of the experimental protocol are presented in the text of the proposal for 2006-08.

Figure 1. Comparison of Fresh and “Rancid” Vegetable Oils as judged by the Peroxide Value Test



Peroxide Value of fresh canola oil plus 5 to 20 ml “phenolic exrtracts

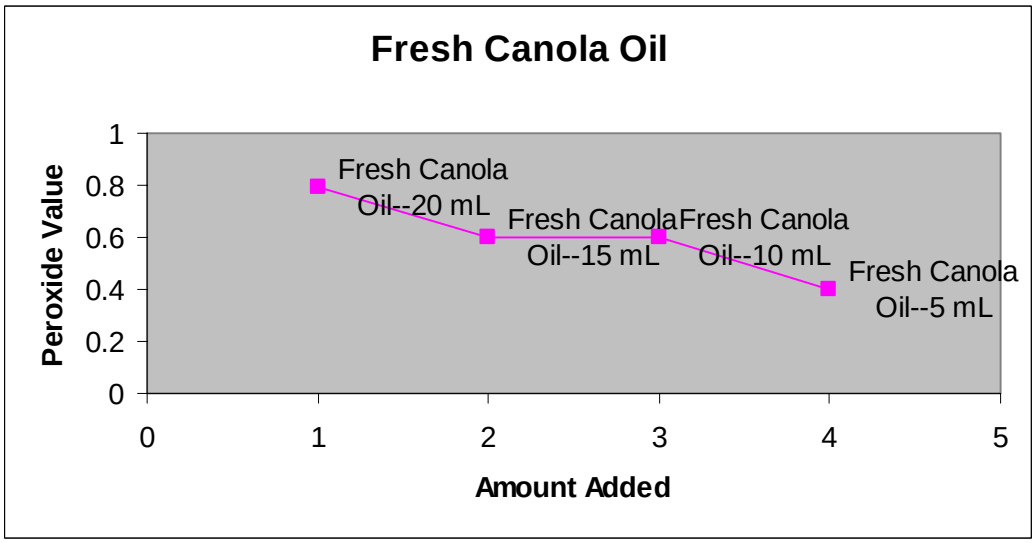
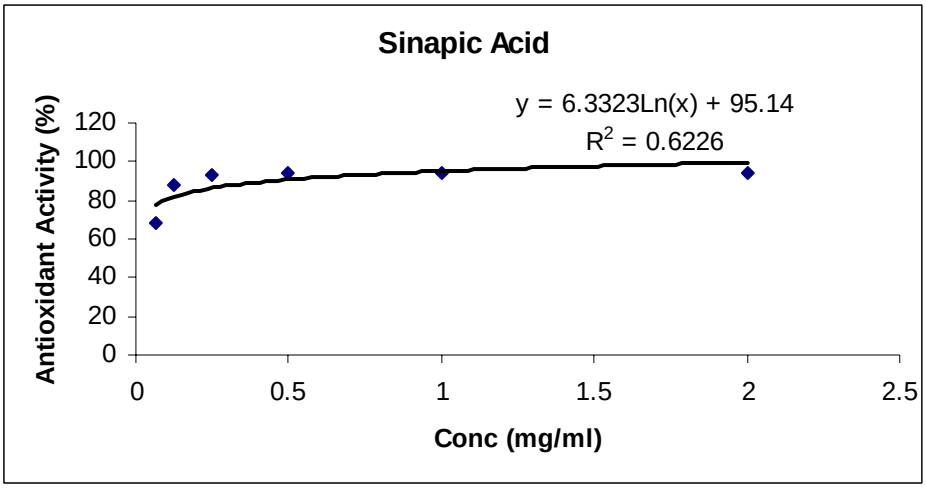


Figure 2. Graphs showing antioxidant activity of pure phenolic standards.



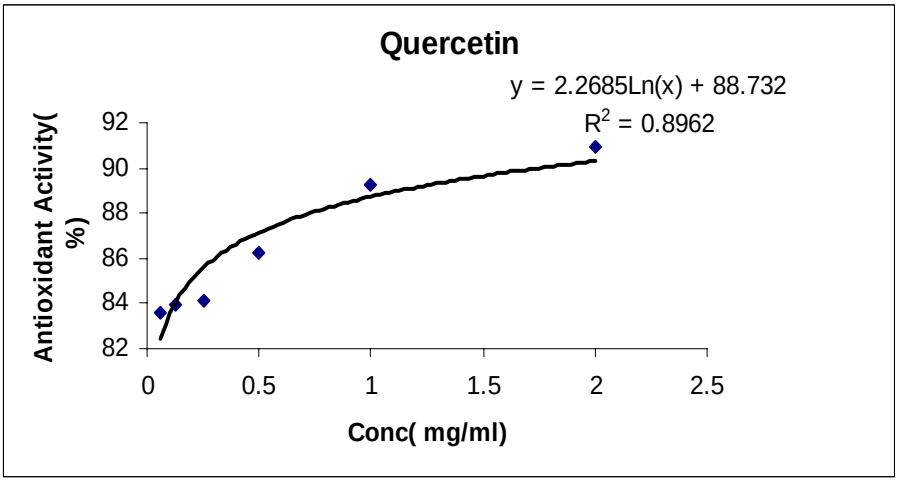


Table 1. Comparison of Phenolic Content and Antioxidant Activity

Sample	Total Phenolics Mg/100g	Antioxidant Activity (%)
Soybean (whole seed)	83.7	4.7
Oat Groat	17.2	3.8
Oat Oil	79.5	3.3
Canola Oil (commercial)	46.7	1.33

Antioxidant in Canola Oil More Potent Than Other, Better Known Antioxidants, Japanese Researchers Find

Date Posted: 11/3/2005

Biotech Week via NewsEdge Corporation : (NewsRx.com) -- The potent alkylperoxyl radical scavenger in crude canola oil, canolol, is more potent than other well-known antioxidants.

"Alkylhydroperoxides in oxidized oil are undesirable components because they become alkylperoxyl radicals (ROO.) in the presence of heme, hemoglobin, or myoglobin in red meat. ROO. are biochemically reactive and damage nucleic acids and proteins, thereby harming living cells," researchers in Japan report.

"We isolated a component, a highly potent ROO. scavenger, from crude canola oil (rapeseed), which we designated canolol, and identified its chemical structure, 4-vinyl-2,6-dimethoxyphenol," wrote D. Wakamatsu and colleagues, Sojo University in Kumamoto.

"The canolol content of crude canola oil greatly increased after the seed was roasted as compared with that from unroasted seed," they found, "but it decreased in highly purified oil. This anti-ROO. activity was highest in crude oil, deceased after each refining step, and was lowest in highly purified refined oil. Canolol was, thus, generated during roasting."

"As shown previously, canolol is one of the most potent anti-ROO. components in crude canola oil," concluded the investigators, "and its potency is much greater than that of well-known antioxidants, including alpha-tocopherol, vitamin C, beta-carotene, rutin, and quercetin."

Wakamatsu and colleagues published their study in Bioscience Biotechnology and Biochemistry (Isolation, identification, and structure of a potent alkylperoxyl radical scavenger in crude canola oil, canolol. Biosci Biotechnol Biochem, 2005;69(8):1568-1574).

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