PROGRESS REPORT

TO

NORTHERN CANOLA GROWERS ASSOCIATION

Project Title: CANOLA OIL REDUCES BREAST CANCER RISK
(Project #: FAR0013012)

Period: 07-01-07 through 03-31-08

Investigators: Chung S. Park, Principal Investigator
Mark L. Bauer, Co-Principal Investigator
Department of Animal Science
North Dakota State University

C. S. Park
Chung S. Park

April 3, 2008
Date

Marc L. Bauer

4/3/08
Date

A. Rationale and Objective:

Breast cancer is the most common malignancy amongst women worldwide, accounting for nearly 1 in 3 cancers diagnosed in American women. There is increasing evidence that it is not the quantity of lipid but the type of lipid intake that influences cancer risk. According to some research, omega-3 and monounsaturated fatty acids, particularly oleic acid, which is the most abundant monounsaturated fatty acid in canola oil, may have anticancer effects. Due to its uniquely balanced fatty acid composition (i.e., oleic and omega-3 fatty acid content), canola oil may reduce breast cancer incidence by influencing cytokine production of immune cells leading to apoptosis of cancer cells.

We hypothesize that canola oil, due to its uniquely balanced fatty acid composition (i.e., high oleic and omega-3 fatty acids), may reduce breast tumor incidence by enhancing anticancer immune cell proliferation and cytokine production. The specific objective is to determine the extent to which dietary canola oil supplementation affects susceptibility to mammary carcinogenesis.

B. Experimental Approach:

Forty female Sprague-Dawley rats (2 to 3 weeks of age) will be assigned randomly to either the control diet (AIN-76) or a diet supplemented with 10.7% canola oil (treatment) for 3 weeks. At 50 days of age, all rats will be injected s.c. with 50 mg of nitrosomethylurea (NMU, a chemical carcinogen) per kg of body weight to induce mammary carcinogenesis. Tumor incidence and immune cell proliferation will be measured.

C. Preliminary Findings:

Over the past several months, our laboratory has been conducting a study funded by the Northern Canola Growers Association to determine the extent to which dietary canola oil supplementation affects the susceptibility to mammary tumorigenesis. While the majority of the data are currently being analyzed, the following data are available as of March 31, 2008. The study is still ongoing and is expected to be done at the end of June, 2008.

Tumor measurement: Forty-two female Sprague-Dawley rats were randomly assigned to either the control diet or diet supplemented with canola oil (added at 10.7% of the diet). At 50 days of age, all rats were injected with 50 mg of NMU per kg of body weight. Tumor size and volume were calculated. The tumor incidence and the number of tumors per rat in the canola fed group were lower than those of the control (**Table 1**). Canola oil fed rats had a lower tumor volume when compared to the control group (2.63 cm^3 vs. 9.26 cm^3, $P = 0.01$). Although not statistically significant, the latency period was short on the control group when compared to the canola oil group (88.5 d vs. 98.8 d, $P = 0.2$).

Table 1. Mammary tumor incidence, latency period, numbers and volume in rats fed either the control diet or diet supplemented with canola oil.

	Treatment*	
	Control	Canola
Tumor incidence (%)	67	52.4
Latency period (days)	88.5 ± 5.57	98.8 ± 6.28
No. tumors (tumors/rat)	1.85 ± 0.29	1.36 ± 0.32
Tumor Volume (cm^3/rat)	9.26 ± 0.39	2.63 ± 0.27

*Values are means ± SEM, n = 15.

Immune cell proliferation. For immune cell proliferation, randomly selected rats per dietary treatment were sacrificed for the collection of the spleen. Splenocytes were cultured in a complete media supplemented with either concanavalin A or lipopolysaccharide mitogens. **Figure 1** shows immune cell proliferation on the culture supplemented with lipopolysaccharide mitogen at day 3, 6, and 9 of incubation. Our study showed a significant increase on the immune cell proliferation in the canola oil fed rats when compared to the control group (P = 0.01 at all three days of incubation).

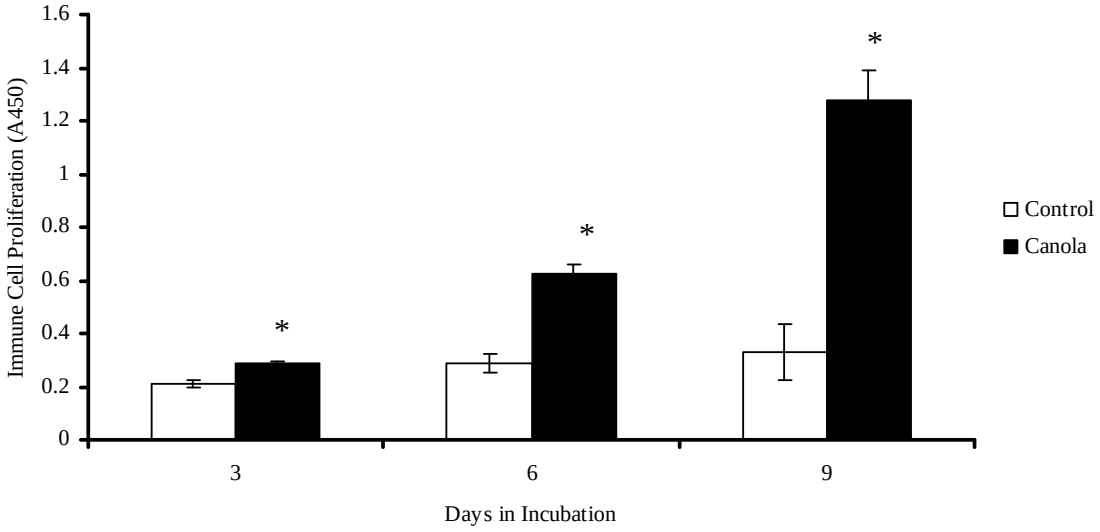

Figure 1. Immune cell proliferation after day 3, 6, and 9 of incubation in a culture media supplemented with Lipopolysaccharide mitogen. Canola oil increased the proliferation of the immune cells. *Significantly different to control when (P = 0.05).

Summary. Dietary canola supplementation significantly reduced chemically-induced mammary carcinogenesis. The immune cell proliferation is increased by canola supplementation supporting tumorigenesis data.

D. Significance

Breast cancer is the second leading cause of cancer death in women. If the proposed study demonstrates that dietary canola oil supplementation reduces mammary cancer incidence, then this data could be useful in the development of improved diets that may prevent and reduce breast cancer in humans. Further, showing that canola oil may reduce breast cancer risk may positively influence the market as well as increase the demand for canola oil, thereby benefiting the canola industry.

E. Work planned in upcoming year (FY 2008)

This project was approved and funded last year (FY 2007). We are requesting the second year funding (FY 2008) to complete the project. Currently funded research is underway and will be completed in June 2008. The preliminary data available is included in this progress report. The entire project is slated for completion by June 30, 2009. The next 15 months or so will be devoted to the completion of analysis from the current experiment and the second year experiment, assay of samples, data analysis, and writing up the report. Data from this study will be presented at the meetings of canola producers and cell/cancer meetings.