

Evidence of the health benefits **of canola oil**

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Canola oil-based diets have been shown to reduce plasma cholesterol levels in comparison with diets containing higher levels of saturated fatty acids. Consumption of canola oil also influences biological functions that affect various other biomarkers of disease risk.

Previous reviews have focused on the health effects of individual components of canola oil. Here, the objective is to address the health effects of intact canola oil, as this has immediate practical implications for consumers, nutritionists, and others deciding which oil to consume or recommend.

A literature search was conducted to examine the effects of canola oil consumption on coronary heart disease, insulin sensitivity, lipid peroxidation, inflammation, energy metabolism, and cancer cell growth. Data reveals substantial reductions in total cholesterol and low-density lipoprotein cholesterol, as well as other positive actions, including increased tocopherol levels and improved insulin sensitivity, compared with consumption of other dietary fat sources.

In summary, growing scientific evidence supports the use of canola oil, beyond its beneficial actions on circulating lipid levels, as a health-promoting component of the diet.

Introduction

Canola is a bright, yellow-flowering plant belonging to the Brassicaceae family. This family includes three different species: *Brassica napus, B. rapa,* and *B. juncea*. Originally from the Mediterranean area and Northern Europe, *B. napus* is commonly known as rapeseed. Rapeseed was identified in 2000 BC as a high-erucic acid crop, containing > 40% erucic acid in the oil.

Due to concerns over erucic acid content that stemmed from animal studies, high-erucic acid rapeseed oil used to be produced in North America solely in small quantities for industrial, non-food use. In 1976, however, Canadian scientists were able to improve the quality of previous cultivars of rapeseed through traditional plant breeding, which led to a conversion to commercially consumable canola cultivars.

In 1979, Canada registered the word 'canola' to describe a new seed found to be oil, which was low in erucic acid and low in glucosinolates. Canola has specific cut-off levels of erucic acid and glucosinolates for both human and animal consumption. In 1977, the low-erucic acid rapeseed oil containing < 5% erucic acid and low glucosinolates was introduced as an edible oil in Europe. In 1985, the Unites States Food and Drug Administration (USFDA) granted canola oil generally recognised as safe (GRAS) status as a dietary component.

Throughout this review, the term 'canola oil' is used to generically refer to the presently available conventional canola oil in North America and conventional LEAR oil in Europe. Other types of canola oil or LEAR are specifically noted.

Over the past 40 years, canola has become one of the most important oilseed crops worldwide. Today, canola oil is the third largest vegetable oil by volume after palm and soya bean oil. The worldwide production of canola oil in 2010/11 was 38 million metric tons, with Europe accounting for 63% and Canada accounting for 31% globally. In the United States (US), canola oil is one of the most widely consumed oils, second only to soya bean oil.

Assessing canola's health benefits

Canola oil is characterised by the following: low level (7%) of saturated fatty acids (SFAs); substantial amounts of monounsaturated fatty acids (MUFAs) and polyunsaturated fatty acids (PUFAs), including 61% oleic acid, 21% linoleic acid, and 11% alpha-linolenic acid; plant sterols (0,53 to 0,97%); and tocopherols (700 to 1 200 ppm), all of which have data indicating they are cardioprotective substances.

With regard to the high MUFA content of canola oil, evidence has been provided supporting positive effects of MUFAs compared with SFAs on cardiovascular health through the regulation of plasma lipids and lipoproteins, susceptibility of low-density lipoprotein (LDL) oxidation, and insulin sensitivity. Also, for the treatment of existing cardiovascular disease, canola oil has been recommended for achieving daily n-3 FA requirements of 1g/day.



Photograph by Keith Jones.

In 2006, the USFDA authorised the following qualified health claim for canola oil: "Limited and not conclusive scientific evidence suggests that eating about 1½ tablespoons (19g) of canola oil daily may reduce the risk of coronary heart disease due to the unsaturated fat content in canola oil. To achieve this possible benefit, canola oil is to replace a similar amount of saturated fat and not increase the total number of calories you eat in a day." This claim was based on the validity of total cholesterol (TC) and low-density lipoprotein cholesterol (LDL-C) levels as biomarkers for coronary heart disease (CHD).

More recently, growing numbers of studies indicate that biomarkers beyond blood lipids are beneficially influenced by canola oil consumption. The objective of this review was to conduct a literature assessment to examine the health benefits of intact canola oil, rather than focus on the effects of individual components in the oil. This approach can be considered more practical since consumers make choices among intact cooking oils for consumption.

Further, this review investigated whether newer data is compatible with earlier conclusions regarding the health benefits of canola oil. The specific aim of this review, based on the most recent literature available, was to describe the effects of canola oil consumption on blood lipids, inflammation, insulin sensitivity, LDL-C oxidation, energy metabolism, and cancer compared with other dietary fat sources.

Effects on blood lipid profiles

SFAs are found in animal fat and dairy products as well as certain types of vegetable oils, including coconut and palm oils. Typical Western diets are high in SFAs. A high amount of dietary SFA may increase TC and LDL-C levels, thus increasing the risk of developing cardiovascular disease. Efforts to substitute SFAs have typically relied on replacement of animal fat and dairy products with liquid vegetable oils high in MUFAs and PUFAs.

Five studies compared canola oil-based diets with typical Western diets, providing evidence that canola oil is able to reduce TC levels by an average of 12,2%. Diets based on canola oil showed positive effects on TC levels regardless of the type of canola oil used compared to a typical Western diet. Seven studies compared canola oil-based diets with those high in SFAs. The high-SFA diets in these studies contained > 12% of energy from SFAs and > 30% of energy from total fat, mainly in the form of butter, margarine, mayonnaise, and other high-SFA foods. Five of the seven studies examined the effects of margarines or mayonnaises made with canola oil on TC levels and all showed a lowering of TC levels, in a range from 3,3% to 21,7%, compared with a high-SFA-treated group.

A group of subjects were fed diets containing canola oil or a high-SFA alternative rather than incorporating the oil into food products; their results demonstrated significant lowering of TC levels with the canola oil, at 8,3% and 15,5%, respectively, compared with the high-SFA alternative. Results from all seven studies consistently showed that replacing higher SFA diets with canola oil decreased TC levels.

Canola vs other vegetable oils

Five studies compared canola or high-oleic canola oil to other high-MUFA or high-PUFA vegetable oils, including a blend of flaxseed and high-oleic canola oils (50/50%) or maize, olive, or sunflower oils. Six studies examined the consumption of canola oil versus high-PUFA oils. In four of these six studies, sunflower oil was chosen as one of the control oils. No significant differences were observed between canola and sunflower oils on the extent of reduction of TC concentration compared to the baseline, resulting in the conclusion that sunflower oil can improve TC concentration as well as canola oil.

Three studies that selected olive oil as the control against canola oil resulted in TC concentration reductions of 12,2, 14 and 11,6% after consumption of canola oil compared to olive oil. Interestingly, the reductions in LDL-C achieved with canola oil were similar when compared with maize and sunflower oils or an oil blend of flaxseed and high-oleic canola oils. However, three studies showed a higher reduction of LDL-C concentrations with canola oil-based diets compared with diets using olive oil.

In vitro and in vivo studies

Not all dietary fats undergo equivalent partitioning for energy expenditure, and some may exhibit satiety promoting actions. To help individuals maintain normal body weight and prevent obesity, studies have examined food intake, satiety, body weight, body mass index, and body composition following consumption of different types of oils. Furthermore, dietary fatty acid composition plays an important role in metabolism and gene expression. Some studies have explored the possible actions of oleic acid-rich oils,

such as olive and canola oils, given older data suggesting preferential partitioning of oleic acid for oxidation versus retention in body storage compartments.

A few studies examined the direct actions of canola oil-based diets on human energy metabolism. For example, an analysis was done of the satiating effect of fat and its physiochemical properties in a double-blind, randomised crossover study. In this study, fat emulsions consisting of 6g of shea, canola oil, or safflower oil were each provided to 15 healthy subjects.

After four days, the canola and safflower oils significantly increased fullness and reduced hunger compared with the saline control treatment, but no effects on food intake were observed. Gut peptides involved in the regulation of satiety and food intake were also analysed in this study. This study concluded that canola oil can increase cholecystokinin levels, which may, in turn, mediate the satiating effects in the ileum.

Sensitivity and tolerance

Evidence has shown that SFA intake is linked with insulin resistance, obesity, and metabolic syndrome. In a review by Gillingham on the health benefits of MUFAs, it was concluded that MUFAs are capable of favourably modulating insulin sensitivity and glycaemic control when substituted for SFAs.

Many dietary intervention studies have tested the effects that a substitution of SFAs with MUFAs or PUFAs has on insulin sensitivity. However, many other factors beyond dietary fatty acid composition may influence glucose tolerance and insulin sensitivity. In this arena, the focus has been on the clinical outcomes of canola oil-based diets on insulin sensitivity and glucose tolerance compared to diets higher in SFAs and unsaturated fatty acids. It was reported that there were lower levels of glucose and steeper glucose disappearance rates in participants who consumed a canola oil-based diet compared with a high SFA diet after an intravenous glucose tolerance test.



Canola has become one of the most important oilseed crops worldwide and canola oil is currently the third largest vegetable oil by volume after palm and soya bean oil. (Photograph: ID 50476719 © Stephan Bock | Dreamstime.com)



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Canola oil and cancer risk

The association between lipid intake and various cancers has been understudied, particularly in humans. While no human clinical trials specific to canola oil and cancer have been performed to date, in vitro and in vivo animal data exist and are examined here.

Plant-based oils such as canola oil, which is a good source (11%) of ALA, have also been examined for their potential to modulate cancer cell growth and death. Protective effects of canola oil compared with maize oil against breast and colon cancers have been reported in various cell and animal studies; however, more research is required to provide definitive direction in this area.

A human case-control study, which determined that total fat intake was positively associated with breast cancer risk when adjustments were made for age, race/ethnicity, and total energy intake, were designed. Also, compared to women cooking only with olive or canola oil, those cooking only with vegetable or maize oil were at 30% increased risk of developing breast cancer. The overarching objective in these studies was to examine the association between dietary fat intake, cooking oil usage, and breast cancer risk in a population-based, multi-ethnic, case-controlled environment.

Among the fat components estimated from the food frequency questionnaires, including SFAs and oleic and linoleic acids, oleic acid was more strongly associated with breast cancer than was linoleic acid, whereas SFA intake failed to associate with breast cancer risk. To conclude, studies exploring linkages between canola oil consumption and cancer risk modification remain equivocal.

Conclusion

After 15 years of continuing research on canola oil since the latest review, evidence shows several potential health benefits of canola oil consumption. Canola oil can now be regarded as one of the healthiest edible vegetable oils in terms of its biological functions and its ability to aid in reducing disease-related risk factors and improving health.

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