Cancer Association of South Africa (CANSA)

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Fact Sheet
on
Canola Oil

Introduction

In the early 1970s, canola was developed using traditional plant breeding techniques to significantly reduce the levels of erucic acid and glucosinolates that were found in the parent rapeseed plant. The name 'Canola' is apparently a contraction of 'Canadian' and 'ola', which means oil.

[Picture Credit: Canola]

There is a strict internationally regulated definition of canola that differentiates it from rapeseed, based upon it having less than two percent erucic acid and less than 30 micromoles of glucosinolates.

Oilseed products that do not meet this standard cannot use the term canola. High erucic acid rapeseed acreage, although still grown, is now confined to production under contract for specific industrial uses, including environmentally friendly lubricants.

Canola oil has generated a lot of research interest into its potential health benefits because of its low level of saturated fat, high monounsaturated fat and good balance of omega 3 and 6 fats .

[Picture Credit: Brassica vegetables]

The canola plant belongs to the same genus of the crucifer family called *Brassica*, the large family of plants, which also includes turnip, mustard, Brussels sprouts, cabbage, kale, cauliflower and broccoli.

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Canola Oil Health Claim

On October 6, 2006 the United States Food and Drug Administration (FDA) ruled that canola oil is eligible to bear a qualified health claim on its ability to reduce the risk of coronary heart disease due to its unsaturated fat content, namely: "19 grams (about 1½ tablespoons) per day may reduce the risk of coronary heart disease due to its unsaturated fat content, according to supportive but not conclusive research. Canola Oil should replace a similar amount of saturated fat in the diet without increasing calories".
(US Food and Drug Administration).

Health concerns about canola oil are, therefore, unfounded.

A Brief History of Canola Oil

1950: The agricultural area seeded to rapeseed dropped to 162 hectares (400 acres) from a high in 1948 of 32 300 hectares (80 000 acres). The postwar availability of other edible oils eliminated the need for rapeseed, but some processors continued to pursue industrial oil export markets. In the early 1950s, both the National Research Council and private oil processors in Canada were experimenting with edible uses for rapeseed, in part because rapeseed looked so promising from an agronomic standpoint, and Prairie farmers needed an alternative cash crop.

1956: The food and drug directorate of the Department of National Health and Welfare (now Health Canada) ruled that rapeseed was not an approved edible oil in Canada. The department was persuaded to withdraw its objection pending a submission to show that the oil was safe.

1958: After some 18 months of feeding trials on experimental animals, in which no harmful effects from feeding rapeseed oil were observed, the directorate removed its objection. During the same year, Dr. Baldur R. Stefansson and Dr. Keith Downey began breeding work to reduce erucic acid content in rapeseed.

1974: Tower, the first canola, was released. This new B. napus variety meant that Canada could now produce oil and meal which was nutritionally superior to that produced from rapeseed in other parts of the world.

1978: The term canola was trademarked by the Western Canadian Oilseed Crushers' Association (now the Canadian Oilseed Processors Association) to differentiate the superior low-erucic acid and low-glucosinolate varieties and their products from the older rapeseed varieties.

[Picture Credit: Canola Plant and Seed]

Canola Oil Facts

Canola oil is one of the healthiest culinary oils in the world with zero trans fat and the lowest amount of saturated fat of all common cooking oils. It has been rigorously tested and approved by authoritative scientific bodies for human consumption. In fact, canola oil is recognised as a heart-

smart cooking oil by many health organisations. The facts about canola are set straight here, showcasing the oil's heart-smart properties and versatility as well as the crop's usefulness in animal and industrial applications.

Scientists agree, canola oil is healthy - clinical studies have been going on for decades involving thousands of human volunteers to examine canola oil and its effects on the body. Canola oil is not only safe for humans per United States, Canadian and other government approvals, but studies have shown it may also have health benefits. Canola oil is free of trans fat and cholesterol, with the lowest amount of saturated fat among common cooking oils, so trials have shown that it may favourably impact the body when used in place of other fat sources. In October 2006, canola oil received a qualified health claim from the United States Food and Drug Administration (FDA) on its ability to potentially reduce the risk of heart disease when used in place of saturated fat in the diet.

[Picture Credit: Canola Oil]

Canola is its own plant species is different from rapeseed - although they look similar, canola and rapeseed plants are very different. Scientists used traditional plant breeding to eliminate the undesirable components of rapeseed, namely erucic acid and glucosinolates. Before canola oil received 'generally recognised as safe' (GRAS) status from the FDA and favourable recognition as a vegetable oil by Health Canada, it had to go through rigorous testing to ensure it was safe for human consumption.

Canola was developed by traditional plant breeding - unwanted traits in rapeseed were bred out through traditional cross-breeding to produce canola in the late 1950s and 1960s. In fact, modern crop biotechnology was not even invented at that time. Today, different varieties of canola help to produce crops that are resistant to drought, pests, disease and other challenges that farmers face. Plant breeders are constantly making breakthroughs to aid growers in getting the most out of their crop.

Canola belongs to the same family as cabbage and cauliflower - Canola, along with cabbage, broccoli and cauliflower, is part of the genus *Brassica*, which belongs to the mustard family of plants. Although members of this family are occasionally mistaken for ingredients in mustard gas, they have nothing to do with it. Mustard gas got its name from its mustard-like odour.

Canola meal is a highly valuable feed for livestock - Canola meal's high protein content makes it a useful and nutritious feed for cattle, fish, chickens and other animals. In dairy cattle, canola meal has been shown in several studies to boost milk production compared to other animal feeds. In 18 studies done over the course of 24 years, results found that using canola meal instead of soybean or cottonseed meal increased milk production by an average of 1 litre per day in each cow.

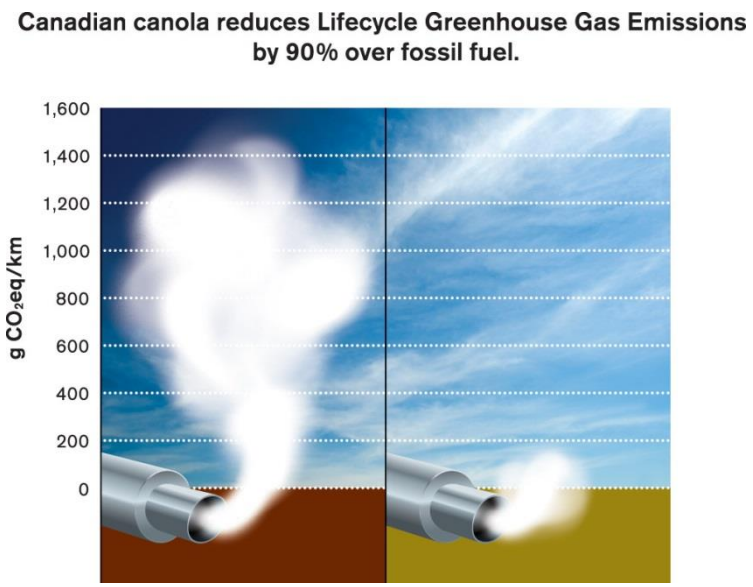
Canola oil is non-allergenic - food allergens are proteins that can cause the body's immune system to react in susceptible individuals. Allergic responses are abnormal ones by the immune system to a specific food. Since traditional refined canola oil does not contain proteins, it will rarely, if ever, cause an allergic reaction.

Canola oil has a long shelf life - Canola oil can be stored at room temperature for about one year. This is about the same shelf life as most other vegetable oils. Store canola oil in a cool cupboard for optimal shelf life.

Canola oil is free of cholesterol and trans fat and low in saturated fat - Canola oil will not raise cholesterol in the body; it is a heart-smart choice for cooking. In fact, canola oil is high in monounsaturated fat, which studies show may help lower 'bad' LDL cholesterol in the blood and control blood glucose. Canola oil also contains an omega-3 fatty acid that may help protect the heart and is a good source of vitamin E.

Canola oil is used in biodiesel, lubricants, soap and other products - any oil derived from plants can be used in making these products. Oils from canola, olives, corn, soybeans and flax can all be used to make a wide range of non-food items, including cosmetics, paints, plastics and more. Vegetable oils can even help fuel one's car with biodiesel. Canola oil is a particularly good feedstock for biodiesel due to its low saturated fat content.

[Picture Credit: Biodiesel]



Health Benefits of Canola Oil

Canola oil has more unique health benefits than many other vegetable-oils and is fast emerging as one of the healthiest oils in tandem with olive oil.

Like olive oil, it is very low in saturated fats. It contains linoleic (omega-6) and α-linolenic acid (omega-3) essential fatty acids at 2:1 making it as one of the healthiest cooking oils at a ratio even better than olive oil.

[Picture Credit: Canola Margarine]

It has the highest levels of plant sterols, especially β-sitosterol and campesterols. The FDA has approved the following claim for phytosterols: "Foods containing at least 0.4 gram per serving of plant sterols, eaten twice a day with meals for a daily total intake of at least 0.8 gram, as part of a diet low in saturated fat and cholesterol, may reduce the risk of heart disease." Phytosterols competitively inhibit cholesterol absorption in the gut and thereby can reduce cholesterol levels by 10% to 15%.

Canola oil is high in kilojoules. However, its high-kilojoule content comes from better fats. It is especially rich in mono-unsaturated fatty acids (MUFA) like oleic acid (18:1) which constitutes about 61% of total fats that help to lower LDL or 'bad cholesterol' and increase HDL or 'good cholesterol' in

the blood. Research studies suggest that the Mediterranean diet that is very rich in monounsaturated fatty acids helps to prevent coronary artery disease and strokes by favouring healthy blood lipid profile.

The oil contains valuable amounts of anti-oxidant vitamin E, particularly gamma-tocopherol. 100g fresh oil has 27.34µg of γ-tocopherol and 17.46µg of α-tocopherol. Vitamin E is a powerful lipid soluble antioxidant, required for maintaining the integrity of cell membrane of mucus membranes and skin by protecting it from harmful oxygen-free radicals.

Being a vegetable source, it has very high levels of plant sterols, especially β-sitosterol. The FDA has approved the following claim for phytosterols: "Foods containing at least 0.4 gram per serving of plant sterols, eaten twice a day with meals for a daily total intake of at least 0.8 gram, as part of a diet low in saturated fat and cholesterol, may reduce the risk of heart disease." Phytosterols competitively inhibit cholesterol absorption in the gut and thereby can reduce cholesterol levels by 10% to 15%.

Canola oil has the highest smoke point of oils - it is also an ideal choice for deep frying because it can be heated to a higher temperature (smoke point 246 °C). This results in lower oil retention in the fried foods.

Fat	Quality	Smoke Point	
Soybean Oil	Unrefined	320°F	160°C
Soybean Oil	Refined	460°F	238°C
Sunflower Oil	Unrefined	225°F	107°C
Sunflower Oil	Refined	450°F	232°C
Canola Oil	High Oleic	475°F	246°C
Olive Oil	Extra Virgin (Unrefined)	405°F	210°C
Olive Oil	Refined	468°F	246°C
Peanut Oil	Unrefined	320°F	160°C
Peanut Oil	Refined	450°F	232°C
Avocado Oil		520°F	271°C
Butter		270°F	136°C

[Credit: Smoke Point of Oils]

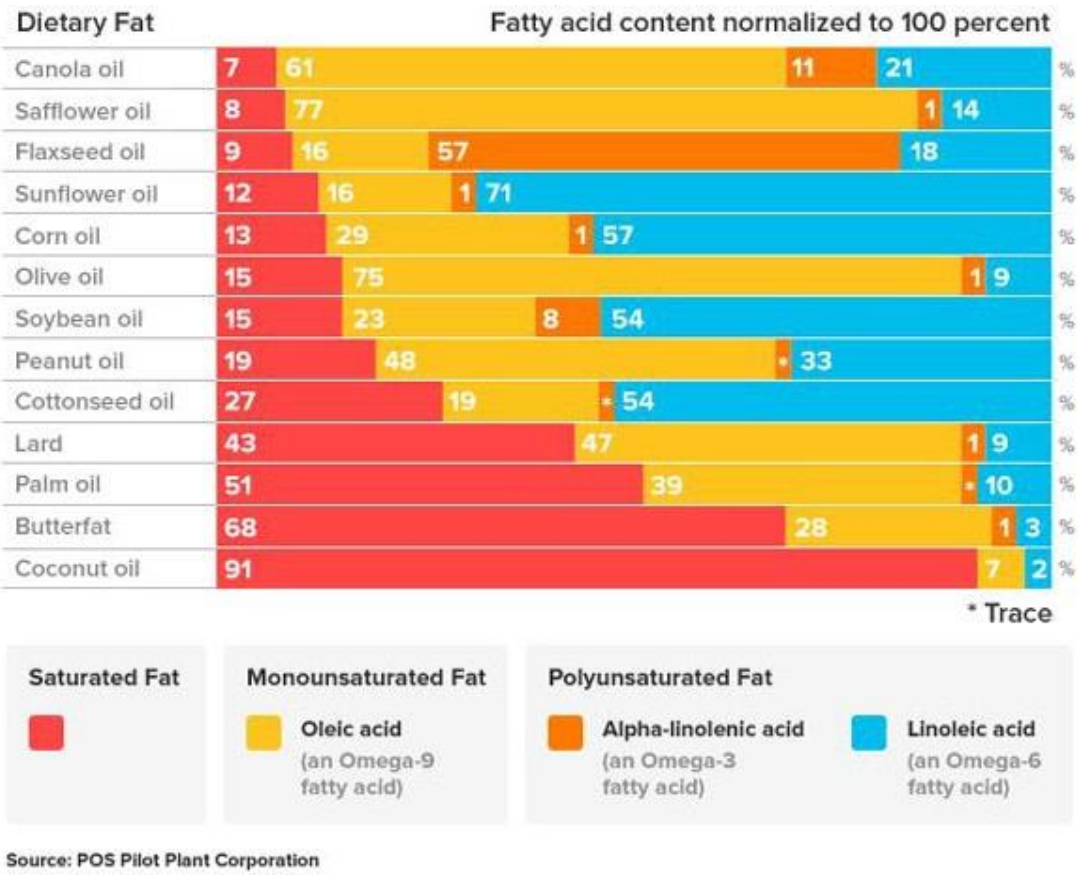
Canola oil is one of the best oils for heart health. Made from the crushed seeds of the canola plant, it has less saturated fat than any other oil commonly used. Check out the numbers: Canola oil has 7% saturated fat, compared to 12% for sunflower oil, 13% for corn oil, and 15% for olive oil. Cutting down on saturated fats helps cut down on one's cholesterol levels.

Canola oil is also very high in healthier unsaturated fats. It is higher in the omega-3 fatty acid alpha-linolenic acid (ALA) than any other oil except flaxseed oil. ALA is particularly important to have in one's diet because one's body cannot make it. Studies show that ALA may help protect the heart through its effects on blood pressure, cholesterol, and inflammation. The FDA allows canola oil makers to label their products with a qualified health claim that there is "limited and not conclusive" scientific evidence that switching out saturated fat for the same amount of canola oil may reduce risk of heart disease.

According to Allemekinders, *et al*., 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.

Canola oil, which is extracted from the seeds of the canola plant, is generally recognised as safe by the United States Food and Drug Administration (FDA). Misinformation about canola oil may stem from the fact that the canola plant was developed through crossbreeding with the rapeseed plant. Rapeseed oil contains very high levels of erucic acid, a compound that in large amounts can be toxic to humans. Canola oil, however, contains very low levels of erucic acid. Canola oil is also low in saturated fat and has a high proportion of monounsaturated fat, which makes it a healthy and safe choice when it comes to cooking oils.

The fatty acid composition of canola oil is consistent with nutrition recommendations aimed at reducing the amount of saturated fat in the diet. When comparing dietary fats, Canola oil is the lowest in saturated fat (7% of total fatty acids), high in mono-unsaturated fat and a good source of omega-3 fatty acids. It also contains zero trans fat and cholesterol. It is therefore one of the healthiest oils available. In studies of both normal and hyperlipidaemic (elevated levels of lipids in the blood) subjects diets containing canola oil have been found to be equally as effective at reducing plasma total and LDL (bad) cholesterol as diets containing corn, safflower, soybean or sunflower oil. Some scientific evidence also suggests that replacing like amounts of saturated fat with canola oil daily may reduce the risk of coronary heart disease due to the unsaturated fat content in the oil.



[Picture Credit: Dietary Fats Comparison]

New research suggests canola oil may be one of the oils of choice for people with Type 2 diabetes. Researchers compared people with Type 2 diabetes who ate either a low glycaemic index diet that included bread made with canola oil, or a whole wheat diet known to reduce the risk of cardiovascular disease. The research found that those on the canola bread diet experienced both a reduction in blood glucose levels and a significant reduction in LDL, or 'bad', cholesterol.

Canola oil health benefits include reducing belly fat and lowering metabolic syndrome risk, say the researchers behind a new clinical trial. Metabolic syndrome is the name for a cluster of risk factors for heart disease, stroke, and type 2 diabetes, which affect one in three American adults, and research suggests that it can be fought by sticking to a Mediterranean diet rich in monounsaturated fats. American and Canadian researchers, who presented their findings at the American Heart Association's 2013 EPI/NPAM Scientific Sessions in New Orleans, found that canola oils used in cooking can decrease abdominal fat. "The monounsaturated fats in these vegetable oils appear to reduce abdominal fat, which in turn may decrease metabolic syndrome risk factors," said Penny Kris-Etherton, a professor at Penn State, in a news release. The clinical trial included 121 participants who had risk factors for metabolic syndrome, which include high abdominal fat, high triglyceride levels in the blood, low HDL cholesterol, high blood pressure, and high blood sugar. The participants were put on a heart-healthy 2000-calorie per day diet for four weeks, and given a daily smoothie with 40 added grams of one of five oils: canola oil, high-oleic canola oil, flax/safflower oil, corn/safflower oil, and a high-oleic canola enriched with omega-3 fatty acids.

Peer Reviewed Research on the Benefits of Canola Oil

The following is a brief overview of recent peer reviewed research articles on canola oil that was published in medical and scientific journals:

Dupont, J., White, P.J., Johnston, K.M., Heggtveit, H.A., McDonald, B.E. Grundy, S.M. & Bonanome, A. 1989. Food safety and health effects of canola oil. *J Am Coll Nutr*. Oct 8(5):360-75.

Canola oil is a newly marketed vegetable oil for use in salads and for cooking that contains 55% of the monounsaturated fatty acid; oleic acid, 25% linoleic acid and 10% alpha-linolenate [polyunsaturated fatty acid (PUFA)], and only 4% of the saturated fatty acids (SFAs) that have been implicated as factors in hypercholesterolemia. It is expressed from a cultivar of rapeseed that was selectively bred from old varieties in Canada to be very low in erucic acid--a fatty acid suspected to have pathogenic potential in diets high in the original rapeseed oil in experimental animals. Canola oil is free of those problems.

It is the most widely consumed food oil in Canada, and has been approved for Generally Recognized as Safe (GRAS) status by the Food and Drug Administration (FDA) of the United States Department of Health and Human Services. The fatty acid composition of canola oil is consistent with its use as a substitute for SFAs, in meeting the dietary goals recommended by many health associations: an average diet containing about 30% of calories as fat made up of less than 10% SFAs, 8-10% PUFAs in a ratio of linoleic to linolenic acids between 4:1 and 10:1, the remainder being monounsaturated fatty acids.

No single oil meets these current recommendations for ratios of PUFA/monounsaturated/ polyunsaturated fatty acid ratios as the sole source of cooking and salad oil.

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Cho, K., Mabasa, L., Fowler, A.W., Walsh, D.M. & Park, C.S. 2010. Canola oil inhibits breast cancer cell growth in cultures *in vivo* and acts synergistically with chemotherapeutic drugs. *Lipids*. Sep 45(9):777-84. Doi: 10.1007/s11745-010-3462-8. Epub 2010 Aug 22.

Certain fatty acids in canola oil (CAN) have been associated with a reduced risk of breast cancer. This study assessed the effects of CAN on proliferation and death of human breast cancer cells in vitro and in vivo in chemically induced mammary carcinogenesis. We hypothesize that CAN reduces breast cancer cell growth by inducing cell death. In a series of in vitro experiments, human breast cancer T47D and MCF-7 cells were cultured and treated with CAN and two chemotherapeutic drugs, tamoxifen and cerulenin.

Cell proliferation and caspase-3 and p53 activities were measured. Reduced cancer cell growth and increased expression of caspase-3 and p53 were seen in T47D and MCF-7 cells treated with CAN. Moreover, CAN showed synergistic cancer cell growth inhibition effects with tamoxifen and cerulenin. In a subsequent live animal experiment, 42 female Sprague-Dawley rats were randomly assigned to corn oil (CORN) or CAN diets, and mammary tumours were chemically induced by N-nitroso-N-methylurea. CAN-dieted rats had reduced tumour volumes and showed an increased survival rate as compared to CORN-dieted rats. We demonstrated that CAN has suppressive effects on cancer growth, and reduces tumor volumes. The results suggest that CAN may have inhibitory effects on breast cancer cell growth, and warrants further investigation of the synergistic effects of CAN with anti-cancer drugs.

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Rzehak, P., Koletzko, S., Koletzko, B., Sausenthaler, S., Reinhardt, D., Grübl, A., Bauer, C.P., Krämer, U., Bollrath, C., von Berg, A., Berdel, D., Wichmann, H.E., Heinrich, J. & GINI Study Group. 2011. Growth of infants fed formula rich in canola oil (low erucic acid rapeseed oil). *Clin Nutr*. Jun 30(3):339-45. Doi.1016/j/clnu.2010.11.002. Epub 2010 Dec 3.

BACKGROUND & AIMS: Canola oil is a variety of rapeseed oil low in erucic acid (<2%). For many years, canola oil has been widely used as an ingredient in infant formula in Europe, but not in North America due to safety concerns. A number of studies have used variable canola content of infant formulas to investigate the effects of linoleic acid: α-linolenic acid ratio on visual function of infants. However, little published data is available to compare the safety of canola versus non-canola containing infant formula. The aim of this study is to investigate whether infant formulas containing canola oil support normal growth in infants as assessed by weight and length gain.

METHODS: Re-analyses of data on infant weight and length gain from a prospective randomized double-blind trial in full-term infants in the German Infant Nutritional Intervention study (GINI). This analysis compared growth in infants receiving infant formulas with or without canola oil from week 4 to month 7. Absolute weight and length, weight and length gain in gram or cm per day and standardized weight and length measurements were analyzed by analyses of variance and a longitudinal random effects model. Standardization was conducted according to the new WHO 2006 age- and sex-specific child growth standards.

RESULTS: Absolute and standardized weight and length measures did not differ between the formula groups with or without canola oil. This was true for both, analyses within each of the three anthropometric measurement periods (4-6 weeks, 3-4 months, 6-7 months) and for the longitudinal analyses over the whole period from 4 weeks to 7 months of life. Power analyses confirmed that

sample size was sufficient to detect a difference of 3 g per day between 14 and 120 days between the two formula groups.

CONCLUSIONS: Infant formula containing canola oil supports normal infant growth as assessed by weight and length gain.

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Przybylski, O. & Aladedunye, F.A. 2012. Formation of trans fats during food preparation. *Can J Diet Pract Res*, Summer, 73(2):98-101.

PURPOSE: An investigation was completed to determine how typical cooking procedures used in food preparation, such as baking and stir-frying, affect trans fats formation. METHODS: Canola oil was used as the main fat ingredient. Zucchini cake and gingersnap cookies were baked at 180o C and 200o C, while stir-fried chicken was prepared at 200o C and 275o C. The lipids from the food were extracted following the Folch procedure, and analyzed for trans fatty acids according to ISO official method 15304.

RESULTS: Minimal changes were observed in the amount of trans fats during baking. Application of extreme temperatures during baking, which caused carbonization of the outer layer of products, yielded an insignificant increase in the amount of trans isomers. As with baking, stir-frying did not result in significant isomerization of the fatty acids, even when the oil was heated to 275o C and smoking heavily before the food was placed in it. Irrespective of the cooking procedure, linolenic acid was the most prone to isomerization with the highest amount of trans isomers formation.

CONCLUSIONS: Baking and stir-frying at normal and/or extreme temperatures do not significantly affect the amounts of trans fats. Likewise, heating oil to the smoking point during stir-frying may decrease the amount of polyunsaturated fatty acids because of oxidative degradation.

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Lin, L., Allemekinders, H., Dansby, A., Campbell, L., Durance-Tod, S., Berger, A. & Jones, P.J. 2013. Evidence of health benefits of canola oil. *Utr Rev*. Jun, 71(6):360-85. Doi: 10.1111.nure. 12033. Epub 2013, May 2.

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 reveal 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.

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Jenkins, D.J., Kendall, C.W., Vuksan, V., Faulkner, D., Augustin, L.S., Mitchell, S., Ireland, C., Srichaikul, K., Mirrahimi, A., Chiavaroli, L., Blanco Mejia, S., Nishi, S.,Sahye-Pudaruth, S., Patel, D., Bashyam, B., Vidgen, E., de Souza, R.J., Sievenpiper, J.L., Coveney, J., Josse, R.G. & Leiter, L.A. 2014. Effect of lowering the blycemic load with canola oil on glycemic control and cardiovascular risk factors: a randomized controlled trial. *Diabetes Care*, Jun, 14.pii:DC_132990/[Epub ahead of print]

Despite their independent cardiovascular disease (CVD) advantages, effects of α-linolenic acid (ALA), monounsaturated fatty acid (MUFA), and low-glycemic-load (GL) diets have not been assessed in combination. We therefore determined the combined effect of ALA, MUFA, and low GL on glycemic control and CVD risk factors in type 2 diabetes.

RESEARCH DESIGN AND METHODS: The study was a parallel design, randomized trial wherein each 3-month treatment was conducted in a Canadian academic center between March 2011 and September 2012 and involved 141 participants with type 2 diabetes (HbA_{1c} 6.5%-8.5% [48-69 mmol/mol]) treated with oral antihyperglycemic agents. Participants were provided with dietary advice on either a low-GL diet with ALA and MUFA given as a canola oil-enriched bread supplement (31 g canola oil per 2,000 kcal) (test) or a whole-grain diet with a whole-wheat bread supplement (control). The primary outcome was HbA_{1c} change. Secondary outcomes included calculated Framingham CVD risk score and reactive hyperemia index (RHI) ratio.

RESULTS: Seventy-nine percent of the test group and 90% of the control group completed the trial. The test diet reduction in HbA_{1c} units of -0.47% (-5.15 mmol/mol) (95% CI -0.54% to -0.40% [-5.92 to -4.38 mmol/mol]) was greater than that for the control diet (-0.31% [-3.44 mmol/mol] [95% CI -0.38% to -0.25% (-4.17 to -2.71 mmol/mol)], P = 0.002), with the greatest benefit observed in those with higher systolic blood pressure (SBP). Greater reductions were seen in CVD risk score for the test diet, whereas the RHI ratio increased for the control diet.

CONCLUSIONS: A canola oil-enriched low-GL diet improved glycemic control in type 2 diabetes, particularly in participants with raised SBP, whereas whole grains improved vascular reactivity.

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Jones, P.J., Senanayake, V.K., Pu, S., Jenkins, D.J., Connelly, P.W., Lamarche, B., Couture, P., Charest, A., Baril-Gravel, L., West, S.G., Liu, X., Fleming, J.A., McCrea, C.E. & Kris-Etherton, P.M. 2014. DHA-enriched high-oleic acid canola oil improves lipid profile and lowers predicted cardiovascular disease risk in the canola oil multicentre randomized controlled trial. *Am J Clin Nutr*, May, pii. Ajcn.081133. [Epub ahead of print]

BACKGROUND: It is well recognized that amounts of trans and saturated fats should be minimized in Western diets; however, considerable debate remains regarding optimal amounts of dietary n-9, n-6, and n-3 fatty acids.

OBJECTIVE: The objective was to examine the effects of varying n-9, n-6, and longer-chain n-3 fatty acid composition on markers of coronary heart disease (CHD) risk.

DESIGN: A randomized, double-blind, 5-period, crossover design was used. Each 4-wk treatment period was separated by 4-wk washout intervals. Volunteers with abdominal obesity consumed each of 5 identical weight-maintaining, fixed-composition diets with one of the following treatment oils (60 g/3000 kcal) in beverages: 1) conventionalcanola oil (Canola; n-9 rich), 2) high-oleic acid canola

oil with docosahexaenoic acid (CanolaDHA; n-9 and n-3 rich), 3) a blend of corn and safflower oil (25:75) (CornSaff; n-6 rich), 4) a blend of flax and safflower oils (60:40) (FlaxSaff; n-6 and short-chain n-3 rich), or 5) high-oleic acid canola oil (CanolaOleic; highest in n-9).

RESULTS: One hundred thirty individuals completed the trial. At endpoint, total cholesterol (TC) was lowest after the FlaxSaff phase ($P < 0.05$ compared with Canola and CanolaDHA) and highest after the CanolaDHA phase ($P < 0.05$ compared with CornSaff, FlaxSaff, and CanolaOleic). Low-density lipoprotein (LDL) cholesterol and high-density lipoprotein (HDL) cholesterol were highest, and triglycerides were lowest, after CanolaDHA ($P < 0.05$ compared with the other diets). All diets decreased TC and LDL cholesterol from baseline to treatment endpoint ($P < 0.05$).

CanolaDHA was the only diet that increased HDL cholesterol from baseline (3.5 ± 1.8%; $P < 0.05$) and produced the greatest reduction in triglycerides (-20.7 ± 3.8%; $P < 0.001$) and in systolic blood pressure (-3.3 ± 0.8%; $P < 0.001$) compared with the other diets ($P < 0.05$). Percentage reductions in Framingham 10-y CHD risk scores (FRS) from baseline were greatest after CanolaDHA (-19.0 ± 3.1%; $P < 0.001$) than after other treatments ($P < 0.05$).

CONCLUSION: Consumption of CanolaDHA, a novel DHA-rich canola oil, improves HDL cholesterol, triglycerides, and blood pressure, thereby reducing FRS compared with other oils varying in unsaturated fatty acid composition.

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Cano-Europa, E., Ortiz-Butron, R., Carmargo, E.M., Esteves-Carmona, M.M., Oliart-Ros, R.M., Blas-Valdivia, V. & Franco-Colin, M. 2016. A Canola oil-supplemented diet prevents Type I Diabetes-caused lipotoxicity and renal dysfunction in a rat model. *J Med Food*. 2016 Nov;19(11):1041-1047.

"We investigated the effect of a canola oil-supplemented diet on the metabolic state and diabetic renal function of a type I diabetes experimental model. Male Sprague-Dawley rats were randomly divided into four groups: (1) normoglycemic+chow diet, (2) normoglycemic+a canola oil-supplemented chow diet, (3) diabetic+chow diet, and (4) diabetic+a canola oil-supplemented chow diet. For 15 weeks, animals were fed a diet of Purina rat chow alone or supplemented with 30% canola oil. Energetic intake, water intake, body weight, and adipose tissue fat pad were measured; renal function, electrolyte balance, glomerular filtration rate, and the plasmatic concentration of free fatty acids, cholesterol, triglycerides, and glucose were evaluated. The mesenteric, retroperitoneal, and epididymal fat pads were dissected and weighed. The kidneys were used for lipid peroxidation (LP) and reactive oxygen species (ROS) quantifications.

"Diabetic rats fed with a canola oil-supplemented diet had higher body weights, were less hyperphagic, and their mesenteric, retroperitoneal, and epididymal fat pads weighed more than diabetic rats on an unsupplemented diet.

"The canola oil-supplemented diet decreased plasmatic concentrations of free fatty acids, triglycerides, and cholesterol; showed improved osmolarity, water clearances, and creatinine depuration; and had decreased LP and ROS. A canola oil-supplemented diet decreases hyperphagia and prevents lipotoxicity and renal dysfunction in a type I diabetes mellitus model."

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Welter, K.C., Martins, C.M., de Palma, A.S., Martins, M.M., Dos Reis, B.R., Schmidt, B.L. & Saran Netto, A. 2016. Canola oil in lactating dairy cow diets reduces milk saturated fatty acids and improves its Omega-3 and Oleic Fatty Acid content. *PLoS One*. 2016 Mar 25;11(3):e0151876. doi: 10.1371/journal.pone.0151876. eCollection 2016.

"To produce milk that is healthier for human consumption, the present study evaluated the effect of including canola oil in the diet of dairy cows on milk production and composition as well as the nutritional quality of this milk fat. Eighteen Holstein cows with an average daily milk yield of 22 (± 4) kg/d in the middle stage of lactation were used. The cows were distributed in 6 contemporary 3x3 Latin squares consisting of 3 periods and 3 treatments: control diet (without oil), 3% inclusion of canola oil in the diet and 6% inclusion of canola oil in the diet (dry matter basis). The inclusion of 6% canola oil in the diet of lactating cows linearly reduced the milk yield by 2.51 kg/d, short-chain fatty acids (FA) by 41.42%, medium chain FA by 27.32%, saturated FA by 20.24%, saturated/unsaturated FA ratio by 39.20%, omega-6/omega-3 ratio by 39.45%, and atherogenicity index by 48.36% compared with the control treatment. Moreover, with the 6% inclusion of canola oil in the diet of cows, there was an increase in the concentration of long chain FA by 45.91%, unsaturated FA by 34.08%, monounsaturated FA by 40.37%, polyunsaturated FA by 17.88%, milk concentration of omega-3 by 115%, rumenic acid (CLA) by 16.50%, oleic acid by 44.87% and h/H milk index by 94.44% compared with the control treatment. Thus, the inclusion of canola oil in the diet of lactating dairy cows makes the milk fatty acid profile nutritionally healthier for the human diet; however, the lactating performance of dairy cows is reduce."

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Andre, C., Buesen, R., Riffle, B., Wandelt, C., Sottosanto, J.B., Marxfeld, H., Strauss, V., van Ravenzwaay, B. & Lipscomb, E.A. 2018. Safety assessment of EPA+DHA canola oil by fatty acid profile comparison to various edible oils and fat-containing foods and a 28-day repeated dose toxicity study in rats. *Food Chem Toxicol*. 2018 Nov 19. pii: S0278-6915(18)30844-5. doi: 10.1016/j.fct.2018.11.042. [Epub ahead of print]

"The omega-3 long-chain polyunsaturated fatty acids (LC-PUFAs) eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) are recognized for their health-promoting qualities. Marine fish and fish oil currently provide the main sources of EPA and DHA for human consumption. An alternative plant-based source of EPA and DHA is provided by EPA + DHA canola event LBFLFK (LBFLFK). A comparative analysis and a 28-day toxicity study assessed the safety of LBFLFK refined, bleached, and deodorized (RBD) oil. Thirty-one different commercially-obtained fat and oil samples were tested, and principal component analysis showed that the overall fatty acid profile of LBFLFK RBD oil was most similar to Mortierella alpina oil and salmon flesh. Samples with the fewest differences in the presence or absence of individual fatty acids compared to LBFLFK RBD oil were menhaden oil and some other fish oils. In a 28-day toxicity study, LBFLFK RBD oil was administered by oral gavage to male and female Wistar rats. No signs of toxicity were evident and no adverse effects were noted in clinical observations, clinical pathology, or histopathology. Overall, these studies support the safety of LBFLFK RBD oil as a source of EPA and DHA for human consumption."

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Ghobadi, S., Hassanzadeh-Rostami, Z., Mohammadian, F., Zare, M. & Faghih. S. 2018. Effects of Canola oil consumption on lipd profile: a systematic review and meta-analysis of randomized

controlled clinical trials. *J Am Coll Nutr*. 2018 Oct 31:1-12. doi: 10.1080/07315724.2018.1475270. [Epub ahead of print]

"Hyperlipidemia is a well- known risk factor of cardiovascular disease. A healthy diet containing vegetable oils such as canola oil(CO) may help to reduce serum lipids. This study aimed to quantify the effects of CO on lipid parameters using a systematic review and meta-analysis of randomized controlled trials. PubMed, Web of Science, Scopus, ProQuest, and Embase were systematically searched until December 2017, with no time and design restrictions. Also, a manual search was performed to find extra relevant articles.

"Lipid parameters including total cholesterol (TC), low-density lipoprotein cholesterol (LDL), high-density lipoprotein cholesterol (HDL), triglycerides (TG), apolipoprotein A1 (Apo A1), and apolipoprotein B (Apo B) were entered the meta-analysis. Weighed mean difference (WMD) and 95% confidence interval (CI) were stated as the effect size. Sensitivity analyses and prespecified subgroup were conducted to evaluate potential heterogeneity. Twenty-seven trials, comprising 1359 participants, met the eligibility criteria. Results of this study showed that CO consumption significantly reduced TC (-7.24 mg/dl, 95% CI, -12.1 to -2.7), and LDL (-6.4 mg/dl, 95% CI, -10.8 to -2), although it had no effects on HDL, TG, Apo B, and Apo A1. Effects of CO on TC and LDL significantly decreased after CO consumption in subgroups of >50 years of age participants and >30 intervention duration subgroup. Moreover, CO decreased LDL and TC compared to sunflower oil and saturated fat. This meta-analysis suggested that CO consumption improves serum TC and LDL, which could postpone heart disease progression. Key Teaching Points CO consumption could decrease serum TC and LDL, although it had no effects on other blood lipids.

"There was an overall significant effect of canola oil on TC and LDL compared to sunflower oil and saturated fats. CO could have beneficial effects on serum TC and LDL just when consumed longer than 30 days. CO consumption improved lipid profiles in participants older than 50 years."

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Medical Disclaimer

This Fact Sheet is intended to provide general information only and, as such, should not be considered as a substitute for advice, medically or otherwise, covering any specific situation. Users should seek appropriate advice before taking or refraining from taking any action in reliance on any information contained in this Fact Sheet. So far as permissible by law, the Cancer Association of South Africa (CANSA) does not accept any liability to any person (or his/her dependants/ estate/heirs) relating to the use of any information contained in this Fact Sheet.

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