The Effect on Lipid Profiles after Supplementation of Cranberry Seed Oil

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Abstract

The purpose of this study was to determine the effects of supplementing cranberry seed oil to a population who had borderline high to high total blood cholesterol levels (>200 mg/dl). A total of 19 participants completed this research study. The experimental group consumed cranberry seed oil daily for eight weeks. The control group consumed canola oil daily for eight weeks. At weeks one, four, and eight a lipid profile test was conducted on each subject. A decrease of 5.7 mg/dl in total cholesterol occurred in the experimental group after just four weeks, with an increase of 4 mg/dl in HDL. These results warrant further research into the in vivo effects of cranberry seed oil supplementation.

Cranberries are a major contributor to Wisconsin's economy. According to the Economic Research Service of the United States Department of Agriculture, Wisconsin was the leading producer of cranberries in the year 2006 (USDA, 2006). The majority of harvested cranberries are further processed to make fruit juice, however, the processing of cranberry juice uses only 85% of the total cranberry. The other 15% of the cranberry consists of the skin, seeds, and pomace. This portion is often thought of as waste when in actuality is the most nutritious part of the fruit because it is packed with powerful antioxidants that have the potential to help fight heart disease (Fruit Essentials, 2006).

Heart disease is the number one cause of death for both men and women in the United States (Centers for Disease Control and Prevention, 2007). High levels of saturated fat and cholesterol in the diet can cause blood cholesterol levels to increase (National Institute of Health, 2005). Excessive cholesterol builds up in the blood, leading to plaque formation and hardening of the arteries. This condition is known as atherosclerosis, which is the leading cause of heart disease, stroke, and heart attacks (U.S. Food and Drug Administration, 2004).

Recently, the oil from cranberry seeds has been analyzed and found to contain a ratio of 1:1 omega-6 polyunsaturated fatty acids (n-6 PUFA) to omega-3 polyunsaturated fatty acids (n-3 PUFA) , all eight isomers of vitamin E, plant sterols, phospholipids, and flavonoids, which have been shown to help reduce cholesterol and thus considered a heart healthy fruit (Fruit Essentials, 2006). Several clinical studies have concluded that 400-800 IU/d of vitamin E is an effective treatment for coronary artery disease (Jial, 1993). Vitamin E does this by reducing the liver's production of cholesterol, inhibiting LDL oxidation, and by being an effective anti-coagulant (Pedersen, 2000).

Even with many benefits attributed to the components of cranberry seeds and oil, to date there has been no published research conducted on the potential benefits of cranberry seed oil supplementation on cholesterol levels in human or animal subjects. It is postulated that the components found in cranberry seed oil may have the potential to effectively alter cholesterol levels.

Method

Subject Selection and Description

The study was a randomized blind-controlled clinical trial. This study utilized a total of 19 volunteers that were 18 years of age or older, not taking any cholesterol altering medications and all had a total blood cholesterol level greater than 200 mg/dl. Lipid profile tests were obtained for all interested participants prior to the start of the study through a blood draw by a certified laboratory technician. At four and eight week intervals, the participants were tested for their lipid profile.

Samples

The samples used in this study were canola oil and cranberry seed oil. Wesson® brand 100% canola oil (lot number 69084-FGC GF2566) was used in the control group for the full eight weeks of the study. The cranberry seed oil used in the experimental group was manufacutred by BGL, LLC (Wisconisn Rapids, WI). The control group was to supplement one tablespoon canola oil per day and the experimental group was to supplement one tablespoon cranberry seed oil per day. At four and eight weeks both the control and experimental groups were tested for their lipid profile.

Equipment

The equipment used for the blood draw included evacuated blood collection tubes, disposable vacutainer holders, gauze pads, tourniquet (single use – disposable – latex free), biohazard needle disposal unit, band-aids, cloth/tape, or stretch bandage wrap, latex-free gloves, and syringes.

Data Analysis

All of the participants' lipid profile tests were analyzed at Red Cedar Medical Center, Menomonie, Wisconsin. The lipid profile results from weeks one, four, and eight were entered into Statistical Package for Social Science (SPSS) statistical software to compare one, four, and eight week profiles among the participants in the experimental and control group. Means and standard deviation for lipid profile were calculated at week one, four, and eight. The differences in total cholesterol, LDL cholesterol, HDL cholesterol, and triglycerides from week 1 and four and week one and eight for both the control and experimental group were calculated using SPSS. The pooled 2-sample t-statistics were calculated for each, and significance was set at $\alpha=0.05$

Results

Total Cholesterol

There were noticeable reductions in total cholesterol in the experimental group after just four weeks of consuming the cranberry seed oil, although not statistically significant ($p<0.05$), $t(17) = -1.48$, $p = 0.16$. The mean week one total cholesterol value for the experimental group supplemented with cranberry seed oil was 240.6 mg/dl with a 5.7 mg/dl decrease at week four, compared to a mean week one total cholesterol value of 233.2 mg/dl for the control group having 3.2 mg/dl increase in total cholesterol at week four (Table 1). The mean week eight total cholesterol value for the experimental group was 247.9 mg/dl, compared to the mean week eight total cholesterol value of 241.2 mg/dl in the control group (Figure 1). One subject in the experimental group was noted to have a 34 mg/dl (13.6%) reduction in total cholesterol at week eight, thus demonstrating the potential improvements in different individuals.

Table 1.

Adjusted Mean (M) and Standard Deviation (SD) Results of Lipid Profile for Control and Experimental Groups[1]

	Week 1		Week 4		Week 8	
	Control	Experimental	Control	Experimental	Control	Experimental
Total Cholesterol (mg/dl)	233.2 ± 27	240.6± 20	236.4 ± 27	234.9 ± 20	241.2 ± 43	247.9 ± 40
LDL cholesterol (mg/dl)	146.3 ± 26	149.3 ± 21	150.3 ± 23	143.9 ± 19	153.0 ± 34	147.9 ± 18
HDL cholesterol (mg/dl)	65.1 ± 14	60.60 ± 16	65.11 ± 15	64.30 ± 16	66.56 ± 17	62.10 ± 16
Triglycerides (mg/dl)	110.8 ± 41	156.20 ± 56	106.6 ± 42	134.60± 65	110.9 ± 38	151.20± 71

[1] Control N = 10; Experimental N = 11; HDL = high density lipoproteins; LDL = Low density lipoproteins

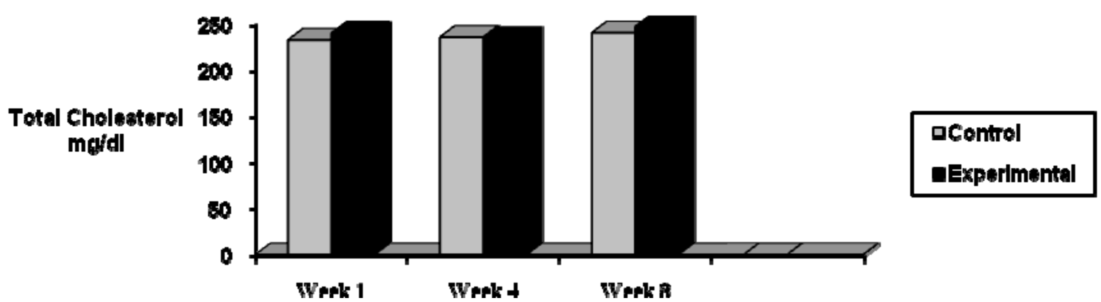

Figure 1. Mean total cholesterol values (mg/dl) at weeks one, four, and eight

LDL Cholesterol

There were also vast reductions in LDL cholesterol in the experimental group supplementing cranberry seed oil at weeks four and eight, although not statistically significant ($p<0.05$), $t(17) = -2.01$, $p = 0.06$. The mean week one LDL cholesterol value for the experimental group was 149.3 mg/dl, but after four weeks, the LDL decreased to 143.9 mg/dl (Figure 2). It was noted that one individual subject in the experimental group had a 24 mg/dl

(12.1%) decrease in LDL cholesterol at week eight. The control group had a mean week one LDL cholesterol value of 146.3 mg/dl, which increased to 150.3 mg/dl at week four and again to 153 mg/dl at week eight (Figure 2). Keeping LDL cholesterol levels at a healthy level is vital for heart health, because, when LDL cholesterol accumulates in the blood stream plaque formation can occur; this increases the risk for heart attack and stroke (Escott-Stump & Mahan, 2004).

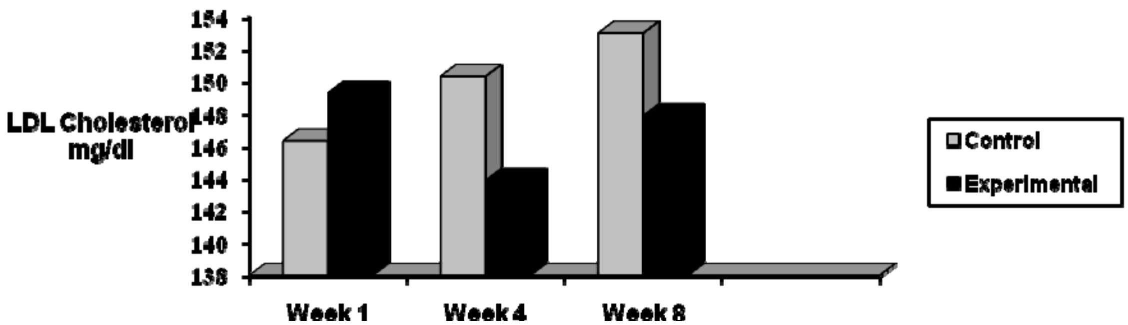

Figure 2. Mean LDL cholesterol values (mg/dl) at weeks one, four, and eight
LDL= low density lipoprotein

HDL Cholesterol

Vast improvements were found in the experimental group after four weeks of cranberry seed oil consumption, although not statistically significant ($p<0.05$), $t(17) = 1.28$, $p = 0.22$. The mean week one HDL cholesterol value for the experimental group was 60.6 mg/dl, which increased to a mean HDL cholesterol value of 64.3 mg/dl at week four, and again increased slightly from week one to 62.1 mg/dl at week eight (Figure 3). In addition, it was observed that one subject in the experimental group had an 11 mg/dl (18%) increase in HDL cholesterol at week eight of the study The control group demonstrated no change in HDL cholesterol value at week four (65.1 mg/dl), however, they did have a slight increase of 1.5 mg/dl at week eight. . Maintaining adequate levels of HDL cholesterol play a key role in heart health. HDL cholesterol helps transfer the LDL cholesterol "bad cholesterol" to the liver where it then is excreted out of the body through bile acids. Excreting excess LDL cholesterol from the bloodstream assists in protecting the heart from plaque formation and heart disease (Groff, Groupper, & Smith, 2005).

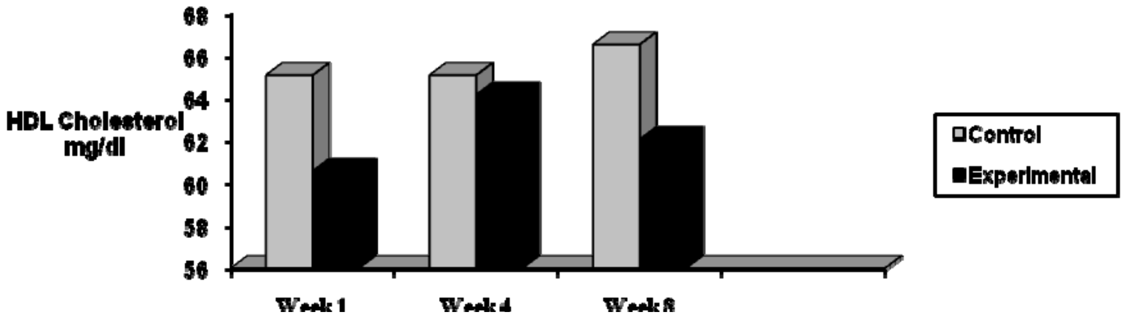

Figure 3. Mean HDL cholesterol values (mg/dl) at weeks one, four, eight
HDL= high density lipoprotein

Triglycerides

There were also considerable improvements in triglycerides for those in the experimental group, however, not statistically significant, t(17) = -1.02, p = -0.32. The mean week one triglyceride value for the group supplemented with cranberry seed oil was initially 156.2 mg/dl, however, at week four this was lowered to 134.6 mg/dl. Between one week supplementation and eight weeks, a 5.0 mg/dl in triglycerides was noted 151.2 mg/dl (Figure 4). The control group, supplemented with canola oil, had a mean week one triglyceride value of 110.8 mg/dl, which decreased to 106.6 mg/dl at week four, but slightly increased by 0.1 mg/dl at week eight to 110.9 mg/dl (Figure 4). Additionally, a subject realized a 46 mg/dl (25.7%) decrease in triglycerides at week eight when supplementing with cranberry seed oil. Triglycerides are the chemical form of fat, which can be found in the blood stream. Elevated levels of triglycerides in the blood stream have been linked to an increased incidence of coronary artery disease. Maintaining a triglyceride level of 150 mg/dl or less in the bloodstream has bee shown to reduce the risk for developing heart disease (American Heart Association, 2007).

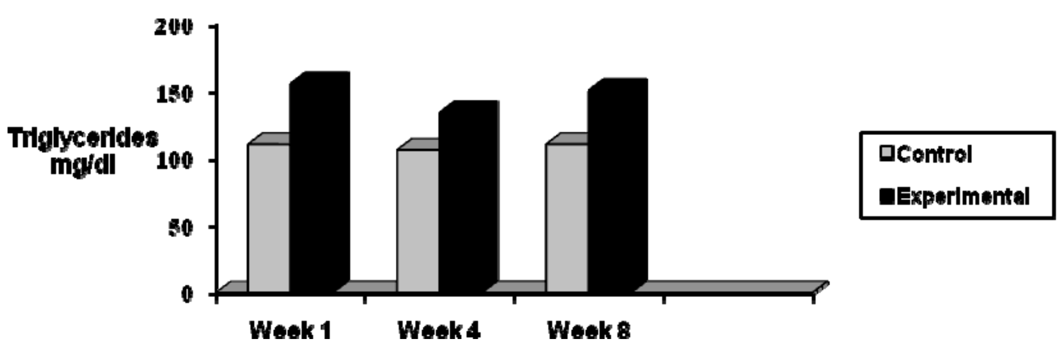

Figure 4. Mean triglyceride values (mg/dl) at weeks one, four and eight

Discussion

Today the number of Americans faced with elevated cholesterol levels and heart disease is increasing. Cranberry seed oil is thought to be an alternative method to statins, bile acid sequestrants, nicotinic acid, and fibrates for improving lipid profile test results and reducing the risk for heart disease.

It is important to allow often discarded by-products, such as cranberry seeds, an enhancement in their value to assist in overlooked health benefits. With this research, food engineers may develop food products that incorporate cranberry seed oil. Consumers, who are concerned with cholesterol levels and interested in a natural way to optimize their health would benefit from these products.

One limitation of this study was its small sample size. An optimal sample size of 55 for both control and experimental groups were calculated at a 5% confidence level and a beta error level of 50% using a sample size calculator (DSS Research, 2006). This means that there would have to be a very large difference between the control and experimental group in order to be considered significant at the level of 0.05.

Another limitation of this study was that the subjects may not have taken the oil in the correct amount diligently throughout the duration of the study. Through personal conversations with the subjects, the researcher became aware that some subjects forgot to take the oil 1-5 days out the course of eight-week study. Subjects in the experimental group also indicated to the researcher that the oil was of great distaste and that they had a hard time taking it every day. Subjects also admitted that they had to chase down the oil with high fat and sugar foods to ward off or mask the strong flavor of the oil. This may have increased the total fat, saturated fat, and cholesterol consumption in the subjects', thus possibly affecting the results of their lipid profile testing.

One recommendation for further research would be to conduct a similar research study utilizing a larger sample size with a minimum of 55 subjects in both the control and experimental groups. This would help to reduce the standard deviation and variance of the data.

Another recommendation for further research would be to conduct a similar research study with subjects in the experimental group supplementing cranberry seed oil in the capsule form. This would improve subject compliance. Also in order to better understand the how the subject's diet affects their lipid profile tests, it would be recommended that all subjects fill out a food frequency questionnaire prior to the start of the study and at week four and eight of the study to determine if changes in diet patterns affect lipid profile results.

In summary, cranberry seed oil supplementation after four weeks did promote an average of 5.7 mg/dl decrease in total cholesterol, an average of 5.4 mg/dl decrease in LDL cholesterol, an average of 3.7 mg/dl increase in HDL cholesterol, and an average of 21.6 mg/dl decrease in triglycerides. This finding suggests that the supplementation of cranberry seed oil has a great potential to help optimize blood cholesterol levels, particularly for an initial duration of up to four weeks supplementation as demonstrated in this study. Therefore, data from this study warrant further investigation into the possible *in vivo* cholesterol-lowering abilities that cranberry seed oil exhibits.

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