

## **Clinical Research Findings: Green Magma Lowers Cholesterol, LDL Oxidation, and Free Radical Activity in the Blood.**

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In the last twenty-five years researchers have published a number of in vitro and in vivo laboratory studies demonstrating that Green Magma and its constituents exhibit potent antioxidant, detoxifying, and cholesterol-lowering properties. Until recently, the findings of these laboratory studies have been supported by only a few clinical trials. However, in the last three years, a series of clinical trials have been published that offer substantial support for the antioxidant and cholesterol-lowering effects of Green Magma in both healthy and health-compromised individuals.

Four clinical studies performed in the last 3 years by Dr. Ching-Min Tsai from the Graduate Institute of Nutrition and Food Science at Fu Jen University and the Department of Bioscience Technology at Chung Yuan University (both in Taipei, Taiwan) and colleagues have demonstrated that dietary changes including daily supplementation with Green Magma may provide several important benefits for cardiovascular function.

Healthy blood flow through our bodies is essential for optimal health and well-being and restrictions in cardiovascular function may result in both acute and chronic problems. While dietary, lifestyle, and genetic factors all play a role in cardiovascular function, dietary changes may offer a relatively convenient means of promoting cardiovascular function, healthy blood flow, and enhanced quality of life.

### **I. Lowering Cholesterol and Preventing LDL Oxidation with a Diet Rich in Unsaturated Fatty Acids and Barley Grass Juice Powder.**

Liu WC, Tsai CE. Young Barley Leaf Prevents LDL Oxidation in Humans. *Food Science and Agricultural Chemistry* [published by The Chinese Institute of Food Science and Technology] Vol. 4 (3): 110-116 (2002).

Research has shown that elevated cholesterol levels and oxidation of low-density lipoproteins (LDL) in the blood are two factors affecting cardiovascular function. The type of fat consumed in the diet can affect both the levels of cholesterol and LDL oxidation. For example, while consumption of a diet rich in saturated fatty acids (SFAs) may increase cholesterol levels, polyunsaturated fatty acids (PUFAs) as found in soybean oil can have the opposite effect. However,

PUFAs may also have the unwanted effect of increasing the oxidation of LDL. On the other hand, studies indicate that monounsaturated fatty acids (MUFAs) found in olive oil, may not lower cholesterol levels but are more resistant than PUFAs to oxidation. Therefore, adding natural, non-toxic antioxidants to the diet along with PUFA-rich dietary oils may be a way of lowering cholesterol without increasing the oxidation of LDL.

This study investigated the effect of barley leaf essence on serum lipids and on the prevention of oxidation of serum low-density lipoproteins (LDL) in healthy male subjects between 18–24 years of age with normal body weight. Forty subjects were randomly divided into four groups of 10 individuals each. Each group received three meals per day of a standard diet composed of 15% protein, 45% carbohydrates, and 40% fat (32.7% from either olive oil or soybean oil.). Subjects were placed into one of 4 groups: olive oil only (O); soybean oil only (S); olive oil + barley leaf essence (OB); and soy oil + barley leaf essence (SB). Groups OB and SB received 5 grams of barley leaf essence powder mixed in cold water with each meal for 15g total per day). All subjects fasted overnight prior to blood samples taken at the beginning and the end of the four-week dietary period. Blood samples were measured for serum lipids (triglycerides, total cholesterol, LDL-cholesterol, HDL-cholesterol, and oxidation of LDL).

## Results

1. None of the four groups showed significant changes in serum triglycerides.
2. Serum total cholesterol was significantly reduced in the two groups consuming barley leaf essence (OB and SB) but not in the groups consuming soy oil or olive oil only (S and O) [\[Figure 1\]](#).
3. Serum LDL-C levels were significantly reduced in both soy oil diets (S and SB) and in the olive oil + barley leaf essence group (OB) but not in the olive oil only group (O) [\[Figure 2\]](#).
4. Serum HDL-C was significantly reduced in both the soy oil groups (S and SB) but not in either of the olive oil groups (O and OB).
5. LDL oxidation (inversely proportional to lag time) was significantly decreased in groups O, OB, and SB but not in the S group [\[Figure 3\]](#).

**SUMMARY:** The results show that ingestion of a diet rich in PUFAs from soybean oil reduces serum total cholesterol, LDL-C and HDL-C, but not LDL oxidation. Adding barley grass juice powder to the soybean diet enhances its cholesterol-lowering effect and lowers LDL oxidation. While MUFAs from olive oil had no effect on total serum cholesterol, LDL-C or HDL-C, they did lower the oxidation of LDL and this effect was enhanced by the addition of barley grass juice powder. Therefore, together with a diet rich in unsaturated fatty acids, 15 g of barley grass juice powder per day as part of the diet may help support cardiovascular activity by reducing cholesterol levels and reducing the oxidation of LDL.

## II. LDL cholesterol and oxidation are significantly reduced in type 2 diabetic patients receiving an olive oil enriched diet supplemented with barley grass juice.

Yu YM and Tsai CE. LDL cholesterol and oxidation are significantly reduced in type 2 diabetic patients receiving a barley leaf essence supplemented olive oil diet. *Food Science and Agricultural Chemistry* [published by The Chinese Institute of Food Science and Technology] Vol. 5 (1): 1–6 (2003).

In the research described previously, Dr. Tsai and colleagues found that unsaturated fatty acid enriched diets supplemented with barley grass significantly lowered both LDL cholesterol and oxidation of LDL in healthy subjects. Since cardiovascular function is compromised in diabetic patients, the researchers examined the effects of barley grass alone and in combination with an olive oil–enriched diet.

The researchers investigated whether supplementation of type 2 diabetic patients with an olive oil–enriched diet and barley grass juice affected the susceptibility of different low–density lipoproteins (LDL) subfractions to oxidation and free radical activity. Thirty type 2 diabetic patients were randomly assigned to three groups: a control group received a placebo only; a second group (BL) received 15 g per day of barley grass juice powder; and a third group (BL+O) received 15 g of barley grass juice powder plus an olive oil–enriched diet. The study lasted for 4 weeks.

### Results

1. Compared to the control group, barley grass juice (BL) alone and in combination with the olive oil–enriched diet (BL+O) significantly decreased both total cholesterol and LDL–cholesterol
2. The BL and BL+O treatments each significantly increased the vitamin E content of both fractions of LDL (B–LDL and Sd–LDL) compared to controls, with BL+O showing the greatest effect
3. Oxidation (inversely related to lag time) of both LDL subfractions was significantly decreased compared to controls, with the BL+O treatment having the greatest effect
4. As measured by chemiluminescence, BL and BL+O treatments each significantly reduced free radical activity in the blood. Additionally, the BL+O treatment significantly increased the monounsaturated fatty acid composition of LDL.

**SUMMARY:** An intake of olive oil together with a dietary supplement of young barley grass juice may be useful as part of the nutritional management of patients suffering type 2 diabetes since it increases the monounsaturated fatty acid composition of LDL, decreases whole blood free radical activities, increases the vitamin E content of LDL, and reduces the susceptibility of LDL to oxidation.

### **III. Barley grass juice powder, alone and in combination with vitamins C and E, fights free radical activity and protects against LDL oxidation in type II diabetic patients.**

Yu YM, Chang WC, Chang CT, Hsieh CL, and Tsai CE. Effects of barley leaf extract and antioxidative vitamins on LDL oxidation and free radical scavenging activities in type 2 diabetes. *Diabetes Metab* Vol. 28 (2): 107–114 (2002).

Diabetic patients are at higher risk of developing cardiovascular problems than the general population. One reason is that high blood sugar, typically found in diabetic patients, increases the oxidation of LDL. Research has shown that vitamins C and E offer protection against oxidation of LDL and are more effective when they are taken in combination rather than alone. However, the small, dense LDL molecules (Sd-LDL), which are implicated to a greater degree than the larger, buoyant LDL molecules (B-LDL) in cardiovascular problems, are not protected as much as B-LDL by vitamins C and E. Therefore, Dr. Tsai and colleagues investigated the effects of supplementation with vitamins C and E in combination with barley grass juice powder on LDL oxidation in diabetic patients.

In the study, 36 randomly selected type 2 diabetics were randomly assigned to receive daily supplements of barley grass juice powder (BL), a combination of 200 mg each of vitamin C and E (CE) or a combination of barley grass juice powder and vitamins C and E (BL+CE) for four weeks. Past research has indicated that antioxidant vitamins C and E taken together can significantly reduce the risk of cardiovascular disease.

#### **Results**

1. Each of the three groups showed a significant decrease in total blood cholesterol
2. In each of the three treatment groups, vitamin E content of both B-LDL and Sd-LDL was increased with the BL+CE group showing the greatest increase
3. Significant inhibition in both sub-fractions of LDL oxidation (inversely related to lag time) occurred in all three groups with the combined treatment group (BL+CE) showing a synergistic inhibition of oxidation in both B-LDL and Sd-LDL
4. Free radical activity as measured by lucigenin-CL and luminol-CL (chemiluminescence) was significantly reduced to a similar degree in all 3 groups. This procedure most likely is a measure of both superoxide radicals and oxygen free-radicals from peripheral blood leukocytes.

The researchers found that supplementation with barley grass reduced the levels of total cholesterol, LDL-cholesterol, LDL-vitamin E depletion, oxidation of LDL, and free radical activity in the blood. The authors noted that barley grass "acts as a free radical scavenger." Particularly noteworthy are the data showing barley grass juice powder, taken with vitamins C and E, more effectively inhibits LDL oxidation than either barley grass or the vitamins taken alone.

**SUMMARY:** The results indicate that supplementation with barley grass juice may help to lower cholesterol, scavenge oxygen free radicals, save the LDL-vitamin E content, and inhibit LDL oxidation. Furthermore, there is a synergistic inhibition of small, dense-LDL oxidation with a combination of barley grass juice and vitamins C and E, an effect that may **promote good vascular function** in type 2 diabetic patients.

#### **IV. Barley Grass Juice or Adlay Reduce Plasma Lipids and LDL Oxidation in Hyperlipidemic Smokers and Non-Smokers.**

Yu YM, Chang WC, Liu CS and Tsai CM. Effects of young barley leaf extract and adlay on plasma lipids and LDL oxidation in hyperlipidemic smokers. *Biol. Pharm. Bull.* Vol. 27 (6): 802-805 (2004).

The previous studies demonstrated that supplementation with 15 grams of barley grass juice daily lowers total cholesterol, LDL cholesterol, reduces the oxidation of LDL, and decreases free radical activity in the blood of both healthy and diabetic individuals. Since smoking and non-smoking individuals with elevated blood lipids are potentially at risk for cardiovascular problems, Dr. Tsai and colleagues decided to determine if the positive effects of barley grass juice supplementation found in healthy and diabetic subjects also apply to these individuals.

In addition to barley grass juice, this study also examined the effects of the grain adlay (*Coix lachryma-jobi*), a relative of oats. The study used forty hyperlipidemic patients; 20 were smokers and 20 were non-smokers. The subjects were divided into two groups: one group received 15 g young barley leaf extract (BL) or 60 g adlay (A) daily for four weeks. Overnight fasting blood samples were taken immediately before and after the four-week period and analyzed for plasma lipids and susceptibility to oxidation of low-density lipoprotein (LDL).

#### **Results**

1. Both total cholesterol (TC) and LDL cholesterol (LDL-C) levels were significantly reduced in both smokers and non-smokers following treatment with either barley leaf (BL) or adlay (A)
2. HDL-cholesterol (HDL-C) was significantly increased in both smokers and non-smokers by barley leaf but not by adlay
3. The lag phase of LDL oxidation significantly increased in both smokers and non-smokers after either supplementation indicating that LDL was less susceptible to oxidation. Barley grass also had a significantly greater antioxidant effect on the prevention of LDL oxidation in non-smokers than did adlay.

**SUMMARY:** Supplementation with either BL or adlay can decrease total and LDL cholesterol as well as susceptibility of LDL-C to oxidation in hyperlipidemic smokers and non-smokers. Barley leaf

extract (barley grass juice) had a stronger antioxidative effect than adlay and the effects of either BL or adlay are less pronounced in smokers.

**Note:** The barley grass juice powder (referred to as “barley leaf essence”, “barley leaf extract”, or “barley leaf”) used in all four of the studies described was provided by YH Products, the manufacturing division of Green Foods Corporation, located in Oxnard, California.

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