Dietary Approach to Adjusting Genetically-Induced High Cholesterol in Swine

Source: Metzger BT, Barnes DM, Reed JD. (2009 Aug). A comparison of pectin, polyphenols, and phytosterols, alone or in combination, to lovastatin for reduction of serum lipids in familial hypercholesterolemic swine. J Med Food. 12 (4): 854-60.

L4909 10/13

Decreasing Dietary Cholesterol Absorption is an Accepted Way to Improve Blood Cholesterol Levels

- **Cell-culture tests in immortal T cell lines**
- **Cell-culture test in human white blood cells**
- **Evaluated cellular cytokine response to a stimulant**

Immuplex calmed T cell response.

Congaplex increased T cell signaling.

Results in mixed white blood cells showed a more adaptogenic response.

Background

The National Cholesterol Education Program (NCEP) suggested in 2001 that a significant reduction in low-density lipoprotein cholesterol (LDL-C) should be induced by dietary changes. In the 2004 update to their clinical guidelines, the NCEP recommended, among other things:

- **Incorporating plant phytosterolsat 2g/day** Phytosterols are cholesterol-like compounds found in plants. They inhibit cholesterol absorption in the intestines by taking up the space in molecules (called micelles) that facilitate cholesterol absorption.
- **Increasing viscous (soluble) fiber to between 10-25 g/day** Soluble fiber can affect cholesterol via a number of pathways. For example, soluble fiber turns into a gel that binds with fat to reduce absorption of sterols and bile acids.

Other research suggests that polyphenols can affect cholesterol levels. Polyphenols, compounds found in fruits, vegetables, and some nuts, have traditionally been studied for their antioxidant effect. However, in recent years, grape seed extract and berry-derived anthocyanin pigments have been examined for their effect on low-density lipoprotein (LDL) cholesterol and high-density lipoprotein (HDL) cholesterol concentrations.

LDL-C	› Low-density lipoprotein cholesterol › Called “bad” cholesterol because it transfers large amounts of cholesterol to cells
VLDL-C	› Very low-density lipoprotein cholesterol › Most triglyceride-rich lipoprotein
HDL-C	› High-density lipoprotein cholesterol › “Good” cholesterol because it transfers cholesterol from cells to the liver
Triglycerides	› The body’s way of transporting fat to cells › Fat that isn’t used becomes a triglyceride and is stored

Design

Because patients with blood cholesterol management are counseled to implement dietary changes, Standard Process researchers, in collaboration with the scientists at the University of Wisconsin-Madison, designed a study to examine the effect of different diet interventions on cholesterol levels in swine with a genetically-altered tendency toward high cholesterol (the Rapacz familial hypercholesterolemic swine, or FH swine–access provided by the Department of Animal Sciences at the University of Wisconsin-Madison).

In this trial, researchers compared the effect of a first-generation statin (Lovastatin) to the effect of dietary interventions on LDL cholesterol levels in the FH swine.

They compared a control diet with and without Lovastatin to 7 diets that included (alone and in combination):

- Pectin (from apples, a type of soluble fiber)
- Polyphenols (including green tea [whole leaf] and extracts of: red wine, green tea, grape seed, and bilberry)
- Phytosterols (mixture of β-sitosterol, campesterol, stigmasterol, brassicasterol, and sitostanol)

The swine were selected at 6 months of age and randomized into treatment groups. They ate the control diet for 4 weeks, then their treatment diet for 4 weeks. Total cholesterol, HDL, LDL, and VLDL cholesterol, and triglycerides were measured each week.

54 Genetically-Altered Swine

↓

Grouped into 9 diets:

Control

Lovastatin

Pectin

Polyphenols Phytosterols

Pectin + Polyphenols + Phytosterols

Pectin + Phytosterols

Pectin + Polyphenols

Polyphenols + Phytosterols

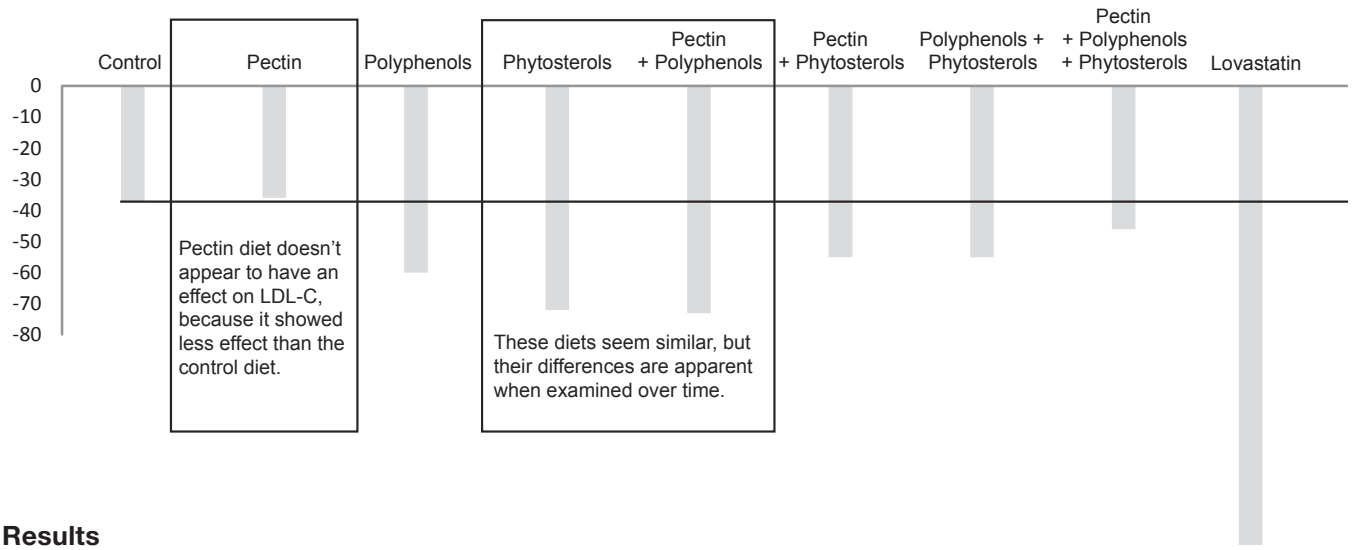
↓

All fed a control diet for 4 weeks; weight noted/ blood drawn weekly

↓

Swine were switched to their assigned diets; weight noted/blood drawn weekly

Average LDL Measurement for Weeks 5-8



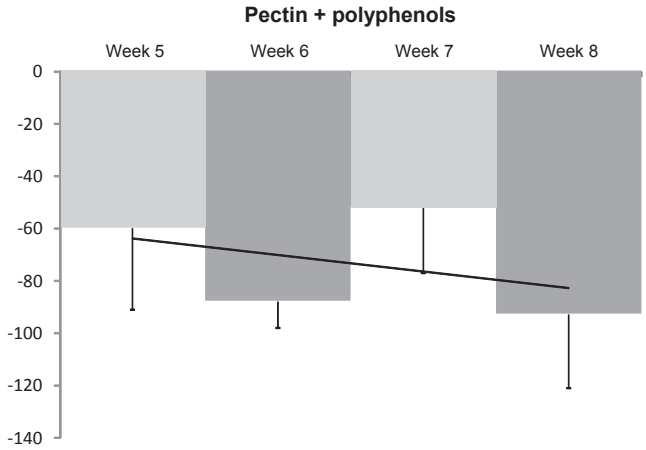
Results

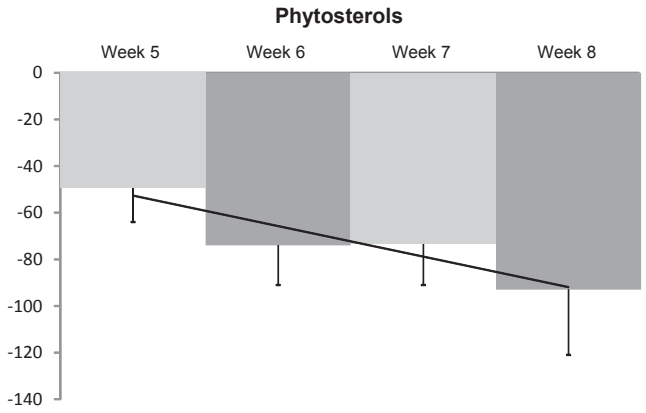
All of the diets, except pectin alone altered LDL cholesterol. This finding is important because this model (FH Swine) mimics genetically high cholesterol, not high cholesterol due to lifestyle. So for even the most severe high cholesterol, dietary changes can contribute to control. Looking at the average amount LDL cholesterol was decreased over the treatment period (weeks 5 - 8) suggests that the two most effective diets were Phytosterol and Pectin + Polyphenols.

However, when the researchers looked at the specific data for weeks 5 - 8, they determined that the phytosterol diet was the most consistently effective.

This result was a surprise.

"While the overall concept of dietary intervention supporting a healthy cholesterol level was born out in our results, we were surprised that the combination diets with phytosterols didn't fare better," said Dr. Metzger. "It's possible that the interaction of components in the phytosterol combination diets affected their activity."





Conclusion

Because Lovastatin regulates the synthesis of cholesterol, and phytosterols decrease cholesterol absorption, the researchers concluded that further research should be done to determine if treatment of high LDL-C levels using diet as an adjuvant to statin treatment would yield better cholesterol management by potentially lowering dosage.