A Dietary Portfolio Approach to Cholesterol Reduction: Combined Effects of Plant Sterols, Vegetable Proteins, and Viscous Fibers in Hypercholesterolemia

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Plant sterols, soy proteins, and viscous fibers are advised for cholesterol reduction but their combined effect has never been tested. We therefore assessed their combined effect on blood lipids in hyperlipidemic subjects who were already consuming a low-saturated fat, low-cholesterol diet before starting the study. The test (combination) diet was 1 month in duration and was very low in saturated fat and high in plant sterols (1 g/1,000 kcal), soy protein (23 g/1,000 kcal), and viscous fibers (9 g/1,000 kcal) obtained from foods available in supermarkets and health food stores. One subject also completed 2 further diet periods: a low-fat control diet and a control diet plus 20 mg/d lovastatin. Fasting blood lipids, blood pressure, and body weight were measured prior to and at weekly intervals during the study. The combination diet was rated as acceptable and very filling. The diet reduced low-density lipoprotein (LDL)-cholesterol by 29.0% ± 2.7% ($P < .001$) and the ratio of LDL-cholesterol to high-density lipoprotein (HDL)-cholesterol by 26.5% ± 3.4% ($P < .001$). Near maximal reductions were seen by week 2. In the subject who took Mevacor and control diets each for 4 weeks, the reduction in LDL:HDL-cholesterol on Mevacor was similar to the combination diet. We conclude that acceptable diets of foods from supermarkets and health food stores that contain recognized cholesterol-lowering dietary components in combination (a dietary portfolio) may be as effective as the starting dose of older first-line drugs in managing hypercholesterolemia.

DIET HAS BEEN considered by some to be ineffective in the management of hypercholesterolemia.[1,2] Nevertheless, it continues to be stressed as the cornerstone for managing raised blood lipids to prevent cardiovascular disease.[3] Recently, in addition to reductions in saturated fat and dietary cholesterol, the National Cholesterol Education Program (NCEP) Panel III has recommended plant sterols (2 g/d) and viscous fibers (10 to 25 g/d) as additional dietary options to maximize the effectiveness of diet.[3] The American Heart Association (AHA) has also drawn attention to the possible benefits of soy proteins.[4] In turn, the Food and Drug Administration (FDA) has permitted health claims for coronary heart disease (CHD) risk reduction for foods delivering adequate amounts of plant sterols,[5] viscous fibers (oat β-glucan and psyllium),[6,7] and soy proteins.[8] However, it is not known whether a combination of these dietary factors will result in an addition, synergy, or quenching of their individual cholesterol-lowering effects. Nevertheless, their proposed modes of action are different, involving increased bile acid losses for viscous fibers,[9-11] increased fecal cholesterol losses for plant sterols,[12,13] and reduced hepatic cholesterol synthesis and increased low-density lipoprotein (LDL) receptor-mediated cholesterol uptake for soy proteins.[14,15]

In view of the differences in possible mechanisms of action and the fact that each agent in acceptable doses may reduce serum cholesterol by 5% to 10%,[16-20] it was assumed that their effects were likely to be additive and that in combination a clinically significant reduction in serum cholesterol could be achieved. This effect may be especially relevant in subjects with lipid concentrations or risk factors just below the cut-off point for drug therapy and for those with muscle tenderness or whose muscle and possibly liver enzyme responses to drug therapy preclude the use of conventional drugs. We therefore studied a group of hyperlipidemic subjects who had taken part in previous studies and were familiar with diet study protocols. These subjects were endeavoring to comply with an NCEP step 2 diet and were provided with the combination diet for 1 month to assess efficacy and acceptability.

MATERIALS AND METHODS

Subjects

Thirteen subjects (7 men and 6 postmenopausal women), age (mean ± SE) 65 ± 3 years (range, 43 to 84 years), with a body mass index (BMI) of 25.6 ± 0.9 kg/m^2 (range, 20.6 to 30.7 kg/m^2) and baseline LDL-cholesterol of 4.50 ± 0.20 mmol/L (range, 3.45 to 6.61 mmol/L) were recruited from patients attending the Risk Factor Modification Center, St. Michael's Hospital. All subjects had taken part in previous dietary studies, were experienced in following dietary protocols, and previously had raised LDL-cholesterol levels (>4.1 mmol/L).[3] At the time of the study, 5 subjects had raised LDL-cholesterol levels, 1 subject had raised triglyceride levels (>2.30 mmol/L), 3 subjects had both raised cholesterol and triglyceride levels, 1 subject had a low high-density lipoprotein (HDL)-cholesterol concentration (<0.9 mmol/L), and 3 subjects had blood lipids in the normal range.[3] No subjects had a history of diabetes, renal or liver disease, and none were taking medications known to influence serum lipids. One subject took antihistamines for a cough in the third week of the study and another subject took anti-inflammatory drugs in the second week of the run-out. Both subjects were excluded from the assessment of C-reactive protein. One subject completed only 3 weeks and withdrew due to

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Submitted April 11, 2002; accepted May 21, 2002.

Supported by Loblaw Brands Ltd, the Almond Board of California, and the Canadian Research Chair Endowment.

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0026-0495/02/5112-0033$35.00/0

doi:10.1053/meta.2002.35578