

Adulthood — treatment

Cholesterol-lowering with plant sterols

Paul J Nestel

PHYTOSTEROLS, OR PLANT STEROLS, are present in high concentration in vegetable oils before they are refined. In recent years the low-density lipoprotein (LDL) cholesterol lowering effect of sterols has been rediscovered, having been established and discarded some 30 years ago. The two main sterols that are widely present in plant foods other than oils are sitosterol and campesterol, and most of us eat between 150 mg and 400 mg of phytosterols daily. Consumption by vegetarians is even higher and may account partly for their lower LDL levels. Sterols can be converted to stanols by saturating double-bonds. Plant stanols are found in lower concentration naturally, but, like sterols, stanols have been incorporated into margarines to lower LDL levels.

In Australia, only sterols, or more accurately sterol esters, have been introduced into margarines. The evidence for their LDL-level-reducing potential is strong, even better than that for eating less saturated fat! With the appropriate intake of about 1.6–2.4 g of sterols daily, the average LDL cholesterol reduction is more than 10% and, importantly, this occurs in about 90% of individuals. A recent analysis of published controlled, double-blind, randomised trials of sterol or stanol esters reported an 11% mean reduction in LDL level.¹ Two studies from Australia with sterol-ester-containing foods, margarine in one² and a mix of margarine, bread and breakfast cereal in the other,³ resulted in mean falls of 7.7% and 13.6%, respectively.

In both trials, this benefit was additional to that achieved with a standard low saturated, low cholesterol, high unsaturated fatty acid diet. Other trials, carried out overseas, have shown that older people benefit most,¹ that patients with various types of dyslipidaemia benefit, and that the LDL-level-lowering effect is additive to that of statins.⁴

The mechanism of action is believed to be through competitive inhibition of cholesterol absorption by phytosterols. Cholesterol requires “solubilisation” within micelles formed in the gut by bile acids and phospholipids; phytosterols may displace cholesterol from the micelle and partly prevent its absorption.⁴ Cholesterol absorption is roughly halved. This explains the synergistic effect with statins; the combination of the two leads to reductions in both absorption and synthesis of cholesterol. A valid argument can be made for including sterol-ester-containing foods in any cholesterol-lowering therapy. It is essential that patients eat the full dose of sterols daily — the practice of lightly covering a slice of toast with sterol-containing margarine is useless.

Summary

- Margarines enriched with plant sterols are effective at lowering low-density lipoprotein (LDL) cholesterol levels when eaten as recommended.
- LDL-cholesterol level reductions of more than 10% are achieved in most people.
- Phytosterol-containing foods are valuable additions to other cholesterol-lowering treatments, including statins.
- They should be considered for all patients with increased cardiovascular risk factors in whom LDL reduction is desirable.
- The only recognised possible adverse effect is reduction in some carotenoids in plasma, but this can be overcome by eating an additional serving of a carotenoid-rich (yellow or orange) fruit or vegetable.

In addition to inhibiting cholesterol absorption, the absorption of some carotenoids, especially beta-carotene, is also affected. This may result in small but consistent reductions in the concentration of this carotenoid in plasma.⁵ However, this must be viewed in perspective. The carotenoid concentrations remain within the range of normality and within the degree of variability encountered among individuals. Similar reductions have been noted with high-fibre diets. Importantly, the small fall in beta-carotene can be overcome by eating an extra serve of carotenoid-rich fruit or vegetables daily.² One unresolved question is whether the absorption of plant sterols into the body, albeit very small, could result in adverse effects over time. The various food regulatory bodies around the world have not considered this a significant issue and the products are generally regarded as safe.

In practice, sterol ester margarines (and other products that may emerge in the marketplace) are a useful ancillary dietary measure for moderately lowering the concentration of LDL cholesterol in people with lesser elevations of blood cholesterol and in patients with increased cardiovascular risk. This accounts for a high proportion of middle-aged and elderly Australians who have such disorders as hypertension, diabetes and insulin-resistance syndrome, and for whom cholesterol-lowering measures are appropriate.

References

1. Law M. Plant sterol and stanol margarines and health. *BMJ* 2000; 320: 861-864.
2. Noakes M, Clifton P, Ntanos F, et al. An increase in dietary carotenoids when consuming plant sterol or stanol esters is effective in maintaining plasma carotenoid concentrations. *Am J Clin Nutr* 2002; 75: 79-86.
3. Nestel PJ, Cehun M, Pomeroy S, et al. Cholesterol-lowering effect of plant sterol ester and non-esterified stanols in margarine, butter and low-fat foods. *Eur J Clin Nutr* 2001; 55: 1084-1090.
4. Miettinen TA, Gylling H. Regulation of cholesterol metabolism by dietary plant sterols. *Curr Opin Lipidol* 1999; 10: 9-14.
5. Weststrate JA, Meijer GW. Plant sterol-enriched margarines and reductions of plasma total and LDL-cholesterol concentrations in normocholesterolaemic and mildly hypercholesterolaemic subjects. *Eur J Clin Nutr* 1998; 52: 334-343. □

Cardiovascular Nutrition Laboratory, Baker Medical Research Institute, Prahran, VIC, Australia.

Paul J Nestel, AO, MD, FTSE, FRACP, Professor, and Senior Principal Research Fellow, and Head.

Correspondence: Professor Paul J Nestel, Cardiovascular Nutrition Laboratory, Baker Medical Research Institute, Prahran, VIC 3181.