Nutrition discussion forum

Functional Foods: cholesterol-lowering benefits of plant sterols

We have read with great interest the Invited commentary section written by Dr David I. Thurnham in a recent issue of the British Journal *British Journal of Nutrition* (Thurnham, 1999). Although we agree with the conclusion of Dr Thurnham, we have detected a few errors in the interpretation section that need to be addressed for more scientific clarity.

Dr Thurnham refers to two studies on stanol-esters (Heinemann *et al*. 1986; Miettinen *et al*. 1995) that demonstrated effective reduction in LDL-cholesterol levels equivalent to that seen in the plant sterol-ester studies (Weststrate & Meijer 1998; Hendriks *et al*. 1999). However, Dr Thurnham fails to refer to a recently published study in *Atherosclerosis* by Gylling *et al*. (1999) which reported the study analysis on plasma carotenoid levels from Miettinen *et al*. (1995). The available published data demonstrate clearly that plant stanol-esters and sterol-esters also have similar effects on plasma carotenoid levels.

In addition, Dr Thurnham has made the comparison between the efficacy of free sterols *v*. sterol-esters extracted from vegetable oils. However, the amount and type of plant sterols reported in the articles by Weststrate & Meijer (1998) and Hendriks *et al*. (1999) refer to free sterols equivalent and not sterol-esters. Therefore, the calculation made by Dr Thurnham on the content of free sterols per day (0·6–1·7 g/d calculated *v*. actual intake of free sterols of 0·83–3·25 g/d) is not correct.

For this reason, the subsequent reasoning regarding the effect of free sterols *v*. sterol-esters on plasma carotenoid levels is flawed. We do not believe that the effect of free sterols on plasma carotenoid levels is different from that of sterol-esters. Dietary intake of free plant sterols in the article by Sierksma *et al*. (1999) is equivalent to the lowest level used by Hendriks *et al*. (1999) and it is much lower than the levels used by Weststrate & Meijer (1998).

Furthermore, it is necessary to compare the effects of free and esterified plant sterols directly in order to make firm conclusions on their relative effects on plasma carotenoids. The between-experiment variation for the reduction in blood carotenoids is large, and the latest study was not designed to be a direct comparison of free *v*. esterified sterols. Therefore, we do not feel comfortable with the conclusion drawn by Dr Thurnham.

References

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Functional Foods: cholesterol-lowering benefits of plant sterols – reply by Thurnham

I thank Dr Weststrate for drawing attention to my misinterpretation of data in the papers by Weststrate & Meijer (1998) and Hendriks *et al*. (1999) in my recent commentary (Thurnham, 1999). My apologies, but on reading these pages again, I still think it is not very obvious that the sterol values quoted do not refer to amounts of sterol esters. In contrast, Sierksma *et al*. (1999) clearly indicate their sterol values as free sterol equivalents and it is hoped that future publications will follow this lead.

My intention was to compare the cholesterol and carotenoid-lowering effects of the free and esterified soyabean phytosterol reported in those publications and it therefore follows from what Dr Weststrate says, that my calculations were not correct and that the intake of free

sterols reported by Sierksma *et al*. (1999) (0·8 g/d) is very similar to the lowest level of esterified sterol reported by Hendriks *et al*. (1999) (0·83 g/d). If we compare the effects of just these two conditions, both forms of plant sterol seem to have a very similar effect on plasma concentrations of total cholesterol (–4·5 %) and lycopene (–12 %) after 3·5 weeks of feeding. In contrast, free sterol did not significantly reduce α- and β-carotene, while esterified sterol reduced them to a similar extent as lycopene. Thus, in spite of the error, this is the same conclusion as arrived at in my commentary but, as pointed out, we cannot make firm conclusions when comparing the two studies as the two preparations were not tested in the same experiment.

Dr Weststrate also draws my attention to a paper by Gylling *et al*. (1999) in which the authors reported serum levels of vitamin D, retinol, α-tocopherol and α- and β-carotene following consumption of sitostanol ester (2 or 3 g/d) by 102 subjects for 1 year. Vitamin D and retinol were unaltered by the treatment but α-tocopherol, α- and β-carotene concentrations were reduced but only β-carotene remained lower if the data were standardised using cholesterol.

In his letter, Dr Weststrate points out that there can be large between-experiment variations in carotenoid reductions and urges caution in comparing different experiments too closely. One also has to question the value of monitoring some of these changes in the fat-soluble nutrients at all. Vitamin D status is more responsive to u.v. exposure than to dietary intake (Holdsworth *et al*. 1984). Serum retinol concentrations are homeostatically controlled and, in Western populations, unaffected by quite large changes in dietary intake (Willett *et al*. 1983). Serum α-tocopherol concentrations are more strongly related to plasma lipids than dietary intake (Thurnham *et al*. 1986) and in the case of α- and β-carotene, serum concentrations only tell us something about the residual amount of these carotenes that are not converted to retinol when they pass through the enterocyte. To make firmer conclusions about the influence of phytosterols and phytostanols on the absorption of β-carotene requires much more intensive experiments to evaluate the postprandial levels of β-carotene and retinol palmitate following experimental meals containing accurately-known amounts of β-carotene (Van Vliet *et al*. 1995; O'Neill & Thurnham, 1998). Even this approach, however, has its problems, as the variation in carotenoids absorbed by different subjects can vary many fold. However, such studies are needed before we can really know the extent to which phytosterols interfere with the absorption of the carotenoids.

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