

Safety assessment of common foods enriched with natural nonesterified plant sterols.

J Tuomilehto et al. *Eur J Clin Nutr* 2009;63(5):684-691.

Background/Objectives: To assess safety during a diet based on low-fat foods enriched with nonesterified wood-derived plant sterols and mineral nutrients related to serum phytosterol, sex hormone and fat-soluble vitamin metabolism. **Subjects/Methods:** Seventy-one study participants (52 women, 19 men) with mild-to-moderate hypercholesterolemia completed the double-blind, placebo-controlled feeding trial lasting for 15 weeks. The subjects were randomly allocated to the sterol group receiving food items enriched with mineral nutrients as well as with a total of 1.25, 2.5 and 5.0 g per day of plant sterols during the first, second and third 5-week periods, respectively, or to the placebo group receiving similar food items without plant sterols. This outpatient clinical trial with free-living subjects was carried out at two hospital clinics. **Results:** Two significant findings were observed. Serum sitosterol concentrations increased from 2.84 to 5.35 mg l⁻¹ ($P < 0.004$ vs placebo) but those of serum total plant sterols did not because of compensatory changes in other phytosterols. The highest plant sterol levels did not exceed 0.6% of total serum sterols. Serum α -tocopherol concentrations decreased in the sterol group by 10% ($P < 0.0002$), but the between-group difference disappeared after adjusting for the change in the carrier (LDL cholesterol). **Conclusions:** Fifteen-week consumption of natural nonesterified plant sterol-enriched food does not cause any serious adverse effects during such a period. However, serum α -tocopherol levels were somewhat reduced in the sterol group suggesting that long-term effects of plant sterols on serum fat-soluble vitamin concentrations should be further explored, especially in relation to very low-fat diets. **Keywords:** plant sterols, cholesterol, sex hormones, vitamins, diet, sitosterol.

Plant sterol consumption frequency affects plasma lipid levels and cholesterol kinetics in humans.

S S AbuMweis et al. *Eur J Clin Nutr* 2009;63(6):747-755.

Background/Objectives: To compare the efficacy of single versus multiple doses of plant sterols on circulating lipid level and cholesterol trafficking. **Subjects/Methods:** A randomized, placebo-controlled, three-phase (6 days/phase) crossover, supervised feeding trial was conducted in 19 subjects. Subjects were provided (i) control margarine with each meal; (ii) 1.8 g/day plant sterols in margarine with breakfast (single-BF) and control margarine with lunch and supper or (iii) 1.8 g/day plant sterols in margarine divided equally at each of the three daily meals (three times per day). **Results:** Relative to control, end point plasma low-density lipoprotein (LDL) cholesterol concentrations were lower ($P < 0.05$) after consuming plant sterols three times per day but were not different when consumed once per day (3.43 ± 0.62 , 3.22 ± 0.58 and 3.30 ± 0.65 mmol/l, control, three times per day and single-BF, respectively). Relative to the control, end point LDL level was 0.21 ± 0.27 mmol/l (6%) lower ($P < 0.05$) at the end of the three times per day phase. Cholesterol fractional synthesis rate was highest ($P < 0.05$) after the three times per day phase (0.0827 ± 0.0278 , 0.0834 ± 0.0245 and 0.0913 ± 0.0221 pool/day, control, single-BF and three times per day, respectively). Cholesterol-absorption efficiency decreased ($P < 0.05$) by 36 and 39% after the three times per day and single-BF phase, respectively, relative to control. **Conclusions:** Present data indicate that to obtain optimal cholesterol-lowering impact, plant sterols should be consumed as smaller doses given more often, rather than one large dose. **Keywords:** plant sterols, single dose, LDL cholesterol, diet, lipoproteins.

Long-term plant stanol and sterol ester-enriched functional food consumption, serum

lutein/zeaxanthin concentration and macular pigment optical density. Tos T. J. M. Berendschot et al. *Br J Nutr* 2009;101(11):1607-1610.

Abstract: Observational epidemiological studies have shown that low carotenoid intake and/or low carotenoid blood levels increase the risk of degenerative diseases like age-related macular degeneration. Functional foods enriched with plant sterol or stanol esters may lower serum concentrations of fat-soluble carotenoids. Theoretically, as a result the macular pigment optical density (MPOD), a marker for eye health, may change. We carried out a double-blind placebo-controlled human intervention trial with a duration of 18 months to evaluate the possible effects of plant stanol and sterol esters on serum lutein/zeaxanthin concentration in relation to the MPOD. Forty-seven subjects were randomly assigned to one of the three treatment groups: margarine without added plant sterols or stanols, plant sterol-enriched margarine, or plant stanol-enriched margarine. Serum cholesterol and lutein/zeaxanthin concentrations and the MPOD were evaluated at baseline and at

study end. Changes in lipid-adjusted serum lutein/zeaxanthine concentrations between baseline and study end differed significantly between the three groups ($P = 0.001$). We found no differences in the MPOD between the three treatment groups, despite the differences in both absolute and cholesterol-standardized serum lutein/zeaxanthine concentrations. This shows that the observed reduction in serum carotenoid concentrations during 18 months consumption of these functional foods does not affect MPOD. **Key Words:** Macular pigment optical density; Plant stanols; Plant sterols; Carotenoids.

Long-term consumption of plant stanol and sterol esters, vascular function and genetic regulation. Helena Gylling et al. *Br J Nutr* 2009;101(11):1688-1695.

Abstract: Polymorphisms of the ABCG5 and ABCG8 genes interfere with cholesterol absorption and synthesis. We determined whether common polymorphisms of these genes regulate the responses of serum cholesterol and vascular function during long-term inhibition of cholesterol absorption. Mildly to moderately hypercholesterolaemic subjects (n 282) completed a 1-year study consuming plant stanol or sterol ester (2 g stanol or sterol) or control spread. Serum cholesterol and non-cholesterol sterols, markers of cholesterol absorption and synthesis, and variables of vascular function and structure were analysed in relation to common polymorphisms of ABCG5 and ABCG8. At baseline, subjects with the 54K allele of ABCG8 had higher brachial endothelial-dependent flow-mediated dilatation than those without it (5.79 (se 0.31) v. 4.46 (se 0.44) %; $P = 0.049$), and subjects with the 632V allele of ABCG8 had larger brachial artery diameter than those without it. Polymorphisms of ABCG5 and ABCG8 were neither associated with serum cholesterol reduction nor changes in cholesterol metabolism or in vascular function. However, in subjects with the 400K allele of ABCG8, intima media thickness (IMT) was increased in all groups more than in those without it ($P < 0.05$). In conclusion, serum cholesterol lowering with absorption inhibition was not associated with polymorphic sites of ABCG5 and ABCG8. However, regulation of baseline cholesterol metabolism and vascular function and structure, and IMT progression during 1 year seemed to share some of the common polymorphic sites of these genes, suggesting a gene-regulated interaction between cholesterol metabolism and vascular function and structure. **Key Words:** Vascular function; Intima media thickness; Cholesterol absorption; Phytosterol esters.