

# The Impact of Galactooligosaccharides on the Bioavailability of Sterols: A Randomized, Crossover, Double-Blind Clinical Trial

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**Abstract:** The hypocholesterolemic effect of milk-based fruit beverages enriched with plant sterols (PS) has previously been demonstrated, obtaining a beneficial effect on the serum inflammatory status as well <sup>[1]</sup>. Galactooligosaccharides (GOS) are added to food products due to their healthy benefit by selectively stimulating growth of specific members of the intestinal microbiota <sup>[2]</sup>. In PS-enriched milk-based fruit beverages, it has been confirmed that the addition of GOS does not affect the bioaccessibility of total PS after a simulated gastrointestinal digestion <sup>[3]</sup>, although it should be confirmed by *in vivo* studies in order to assure their functionality. In this work, the impact of the presence of GOS on the serum levels of cholesterol, its precursors and metabolites, and on the bioavailability of PS has been evaluated by means of a randomized, double-blind, crossover, placebo-controlled study with postmenopausal women ( $n = 41$ ,  $58 \pm 4$  years). Volunteers consumed daily 250mL of a PS-enriched beverage (0.8%, w/v) with or without GOS (1.7%, w/v) for 6 weeks and serum samples were collected before and at the end of each intervention period. Total cholesterol serum levels were measured by a routine quality-controlled method <sup>[4]</sup> whereas cholesterol precursors (desmosterol and lathosterol) and metabolites (cholestanol), and PS contents (campesterol, stigmasterol and  $\beta$ -sitosterol) were measured by GC-FID [1]. Intake of both beverages (without and with GOS addition) led to a statistically significant decrease ( $p < 0.05$ ) in total cholesterol serum levels (4.7-5.1%), without significant differences between beverages. Also, significant increases in serum concentrations of campesterol (13.6-23.5%) and  $\beta$ -sitosterol (35.7-38.8%) were only observed, as markers of dietary PS intake. No significant differences in the percentages of change of any sterol were detected between beverages, suggesting no effect of the presence of GOS on PS bioavailability or cholesterol metabolism. In conclusion, this *in vivo* study demonstrates the suitability of the simultaneous enrichment of the beverages with PS and GOS considering their potential functional effect.

**Keywords:** clinical trial; cholesterol precursors; galactooligosaccharides; milk-based fruit beverages; plant sterols; serum

[1] Alvarez-Sala et al. (2018), *Food Funct.*, 91: 5209-5219; [2] Gibson et al. (2017), *Nat. Rev. Gastroenterol. Hepatol.*, 14: 491-502; [3] Blanco-Morales et al. (2018), *Food Funct.*, 9: 2080-2089; [4] Granada-Lorencio et al. (2014), *Nutr., Metab. Cardiovasc. Dis.*, 24:1090-1096.

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