# The impact of galactooligosaccharides on the bioavailability of sterols: A randomized, crossover, double-blind clinical trial

## V. Blanco-Morales<sup>a</sup>, R.A. Silvestre<sup>b</sup>, A. Alegría<sup>a</sup>, G. Garcia-Llatas<sup>a</sup>



<sup>a</sup> Nutrition and Food Science Area. Faculty of Pharmacy. University of Valencia. Spain.

<sup>b</sup> Clinical Biochemistry, Hospital Universitario Puerta de Hierro-Majadahonda, Universidad Autónoma de Madrid, Spain

## Introduction

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 [1]. Galactooligosaccharides (GOS) are added to food products due to their healthy benefit by selectively stimulating growth of specific members of the intestinal microbiota [2]. It has been confirmed in PS-enriched milk-based fruit beverages that the addition of GOS does not affect the bioaccessibility of total PS after a simulated gastrointestinal digestion [3], although it should be confirmed by *in vivo* studies in order to assure their functionality.

## Objective

100 μL feces + 20 μg

5α-cholestane + 1 mL

KOH 0.71M (65°C/1 h)

To evaluate the impact of the presence of GOS on the serum levels of cholesterol, its precursors and metabolites, and on the bioavailability of PS

#### Methodology Beverages (250 mL/daily) Without Composition: GOS Skimmed Fruit Plant sterols juice milk (0.8%, w/v)With GOS (1.7%, w/v) Clinical trial (NCT03469518) Randomized, double blind, crossover study 6 weeks 6 weeks 4 weeks (250mL/day) (250mL/day) Randomized Beverage Beverage postwith GOS without GOS Whas-out period menopausal women Beverage Beverage $(n=42, 58 \pm 4 \text{ years})$ without GOS with GOS Post-treatment Pre-treatment Post-treatment Pre-treatment **Feces** sampling Determination of sterols Routine quality-controlled method [4] by the Cholesterol Clinical Biochemistry Department (Hospital Universitario Puerta de Hierro-Majadahonda) Desmosterol and lathosterol **Cholesterol precursors: Cholesterol metabolite:** Cholestanol PS: Campesterol, stigmasterol and β-sitosterol Method described by Alvarez-Sala et al. [1] Sterol Unsaponifiable Saponification quantification Derivatization extraction GC-FID

Pyridine:BSTFA+1%TMCS

(10:3) (65°C/1 h)

CP-Sil8 CB (50m x 25

mm x 0.25 µm); carrier:

 $H_2$  (1 mL/min)

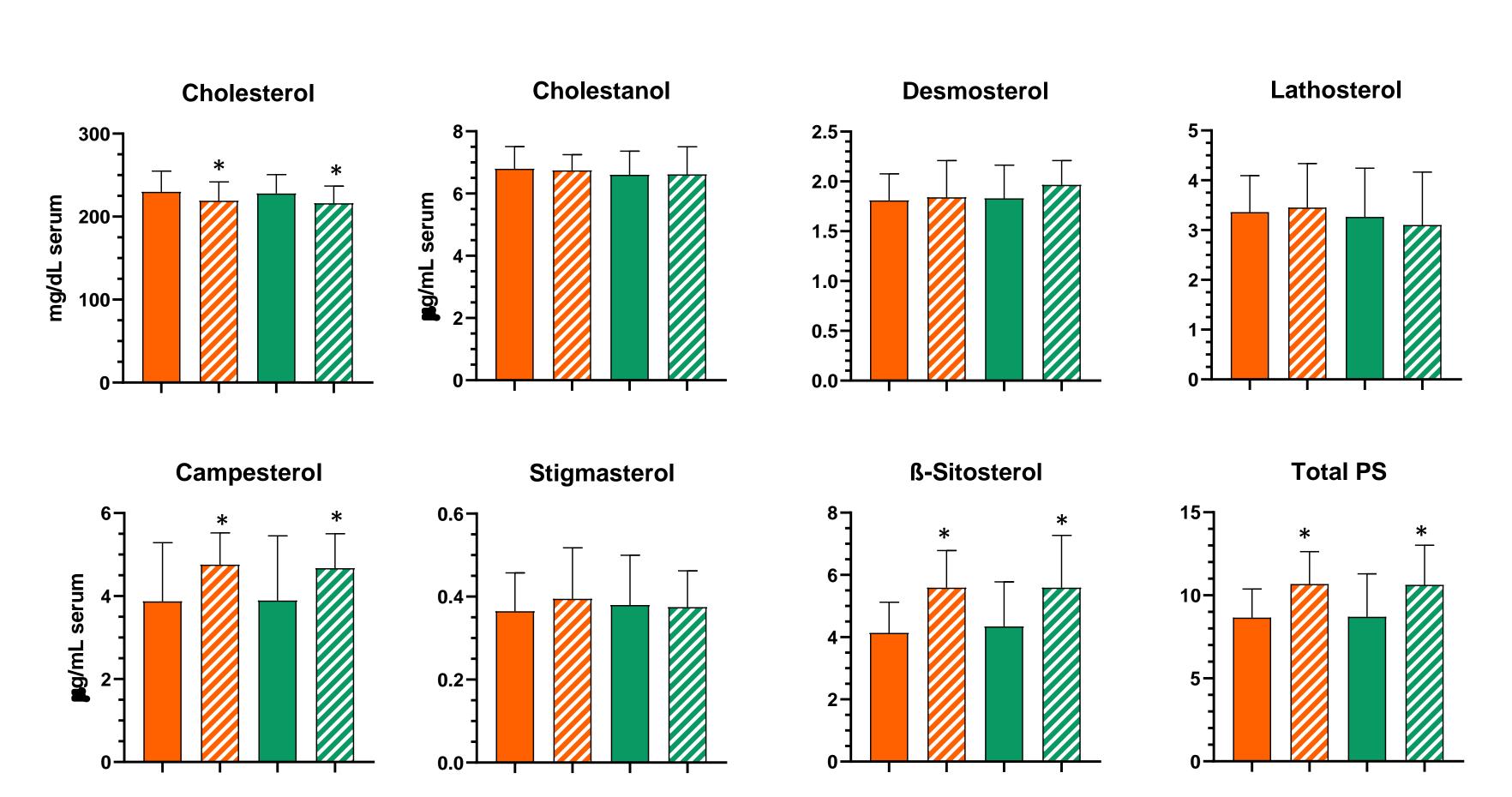
Whases with hexane and

centrifugation

(18°C/3600 rpm/10 min)

## Results

#### Sterol response in serum upon regular consumption of the beverages



Results of cholesterol are expressed as mean  $\pm$  standard deviation. The rest of the sterols are expressed as median with interquartile range. \*Significant differences (p < 0.05) in the same kind of beverage (without or with GOS) among pre-treatment and post-treatment values

Without GOS Pre-treatment Pre-treatment Pre-treatment Post-treatment Post-treatment

The regular consumption of both beverages led to a statistically significant decrease in total cholesterol serum levels (4.7-5.1%), without significant differences between beverages. However, no significant differences for any cholesterol precursor or metabolite were observed between pre- and post-treatment or between beverages. Significant increases in serum concentrations of campesterol (13.6-23.5%) and  $\beta$ -sitosterol (35.7-38.8%) were determined, as markers of dietary PS intake.

The absence of significant differences between beverages suggests no effect of the presence of GOS on PS bioavailability or cholesterol metabolism.

#### Conclusions

The results of the present *in vivo* study demonstrate that GOS addition to PS-enriched milk-based fruit beverages seems not to affect PS bioavailability nor cholesterol metabolism. Thus, the suitability of the simultaneous enrichment of the beverages with PS and GOS considering their potential functional effect is confirmed.

### Acknowledgements

This study is part of the National Project AGL2015-68006-C2-1-R, financed by the Ministerio de Economía y Competitividad (MINECO) and the Fondo Europeo de Desarrollo Regional (FEDER). Virginia Blanco-Morales holds a research contract under the project AGL2015-68006-C2-1-R (Ref. CPI-17-025).

## References

[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] Granado-Lorencio et al. (2014), Nutr., Metab. Cardiovasc. Dis., 24:1090-1096.