Foods 2021

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UPDATING THE INFOGEST DIGESTION METHOD FOR STEROL BIOACCESSIBILITY BY THE SIMULTANEOUS ADDITION OF GASTRIC LIPASE AND CHOLESTEROL ESTERASE

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BIONUTEST research group

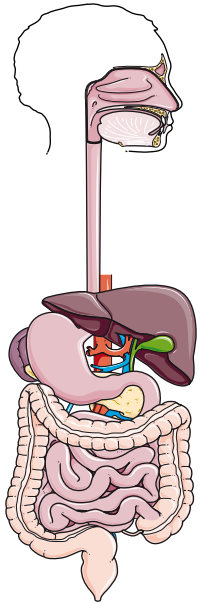
BACKGROUND

Gastrointestinal digestion simulation methods → Bioaccessibility evaluation

Factors → Temperature, time, pH, agitation, enzymes, bile salts…

↓

Harmonized INFOGEST method [1,2]



Salivary amilase (75 U/mL)

Pepsine (2000 U/mL) and **gastric lipase (GL) (60 U/mL)** → **INFOGEST 2.0** [2]

Pancreatin (100 U TAME/mL) and bile salt (10 mM)

[1] Minekus et al. Food Funct, 2014, 5, 1113-1124
[2] Brodkorb et al. Nat Protoc, 2019, 14, 991-1014

BACKGROUND

Adaptation of INFOGEST method to evaluation of sterol bioaccessibility [1]

- Bile salts of bovine origin (10 mM)

PS-enriched milk-based fruit beverage

Optimization of INFOGEST method adapted for sterols: GL **or** cholesterol esterase (CE) [2]

- **Bioaccessibility reduction**
  - **Plant sterols (PS): by 18-62%**
  - **Cholesterol: by 47% (non-quantifiable with cholesterol esterase)**

[1] Blanco-Morales et al. Food Funct, 2018, 9, 2080-2089; [2] López-García et al. 2021, pp 44. Available at: https://www.cost-infogest.eu/content/download/4051/35805/file/V-ICFD%20Book%20of%20Abstracts.pdf

BACKGROUND

Adaptation of INFOGEST method to evaluation of sterol bioaccessibility [1]

- Bile salts of bovine origin (10 mM)

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Optimization of INFOGEST method adapted for sterols: GL **or** cholesterol esterase (CE) [2]

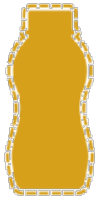
Combination of → GL, CE → More physiologically relevant

[1] Blanco-Morales et al. Food Funct, 2018, 9, 2080-2089; [2] López-García et al. 2021, pp 44. Available at: https://www.cost-infogest.eu/content/download/4051/35805/file/V-ICFD%20Book%20of%20Abstracts.pdf

OBJECTIVE

To evaluate the influence of combined addition of gastric lipase and cholesterol esterase to the INFOGEST 2.0 gastrointestinal digestion, on the sterol bioaccessibility in a plant sterol-enriched milk-based fruit beverage

DIGESTION GASTROINTESTINAL AND STEROL DETERMINATION



PS-enriched milk-based fruit beverage (2.5 g PS/250 mL) or Blanks

In vitro digestion → INFOGEST [1] + GL (60 U/mL) + CE (0.075 or 2 U/mL)

Centrifugation (90 min, 4°C, 3100 g)

Bioaccessible fraction (BF)

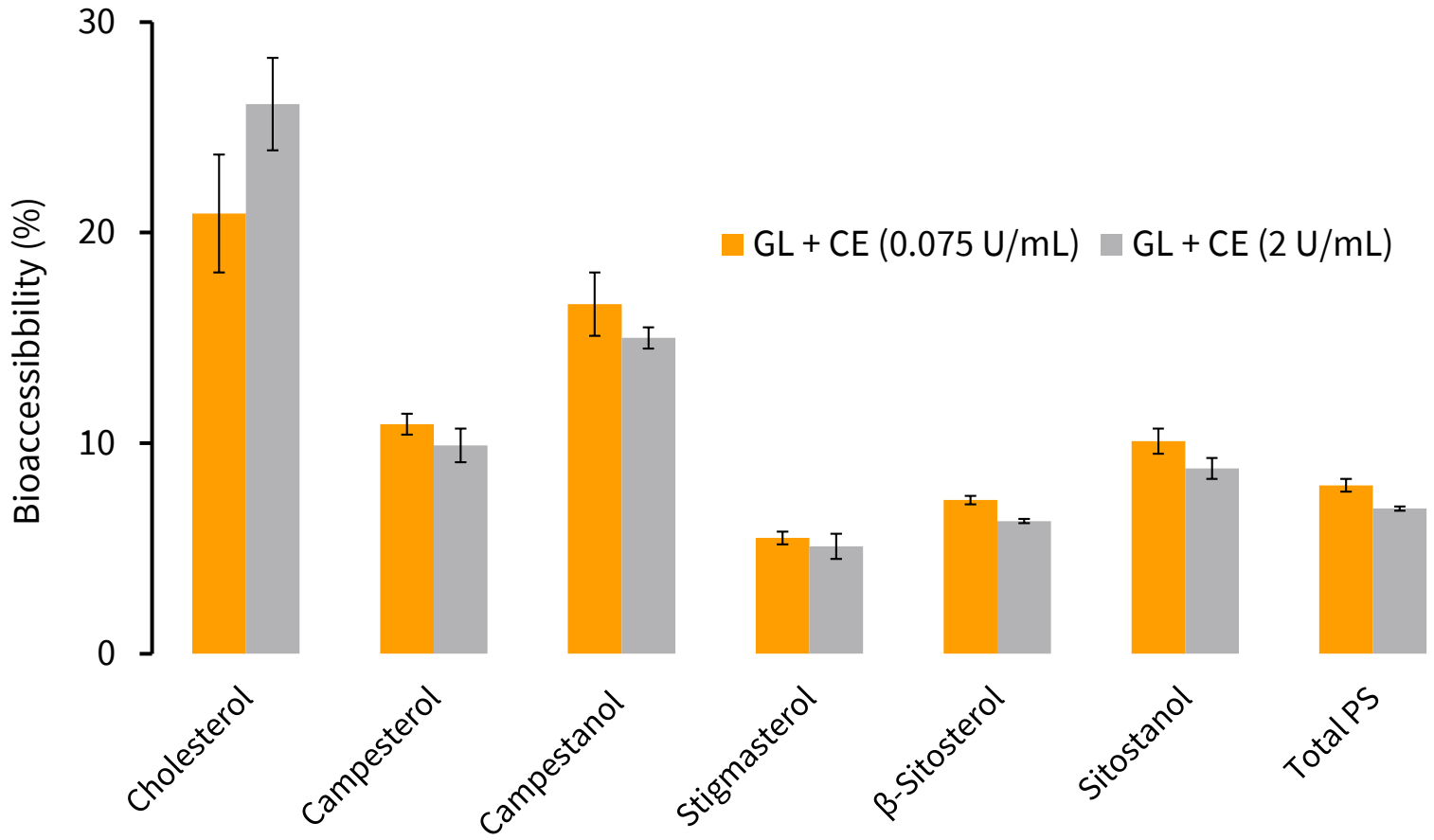
Sterol determination by GC-FID [1]

$$\text{Bioaccessibility (\%)} = \frac{\text{Sterol content in BF}}{\text{Sterol content in beverage}} \times 100$$

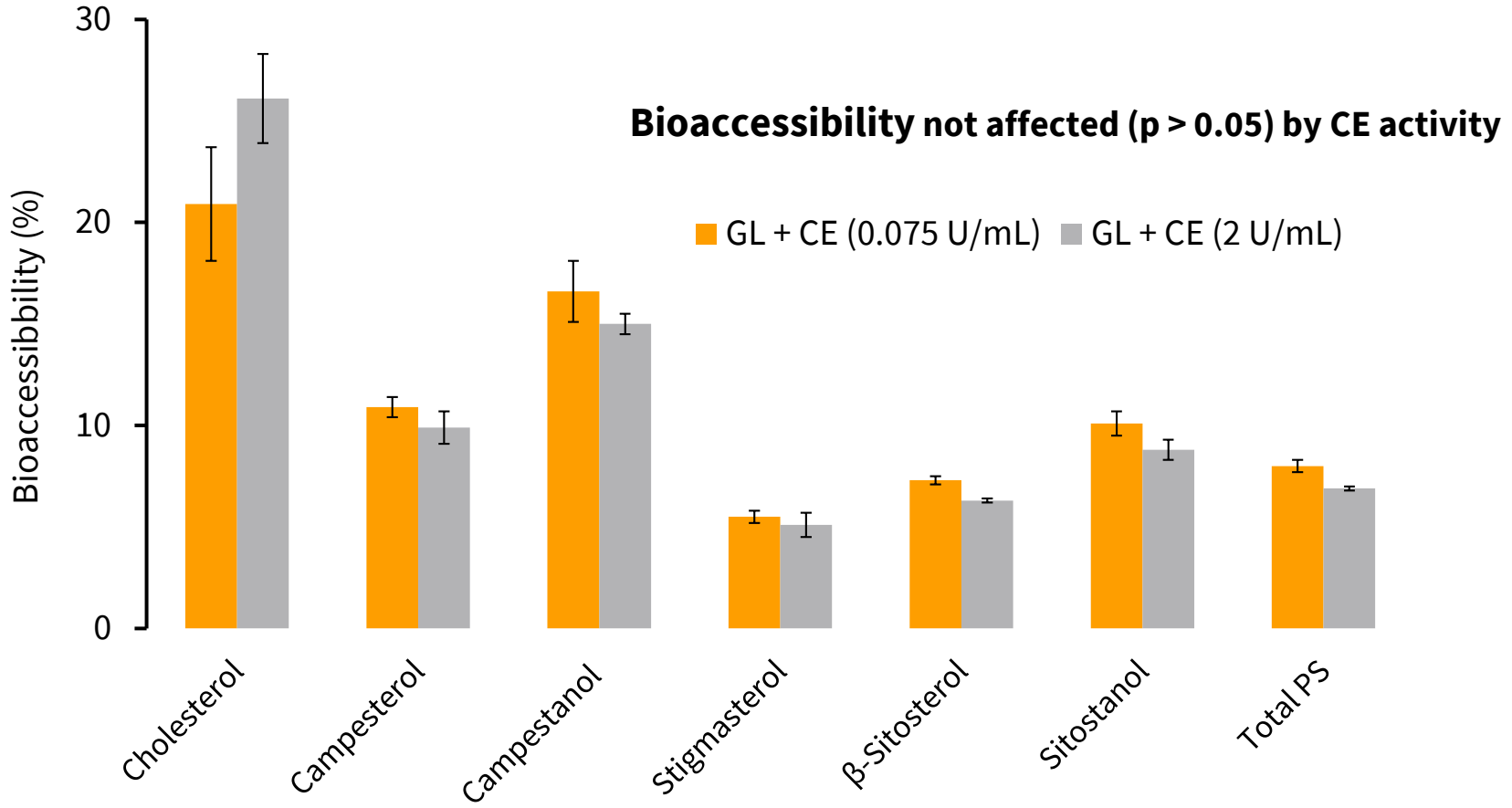
PS: plant sterols; BF: bioaccessible fraction; GC-FID: gas chromatography-flame ionization detection

[1] Blanco-Morales et al. Food Funct, 2018, 9, 2080-2089.

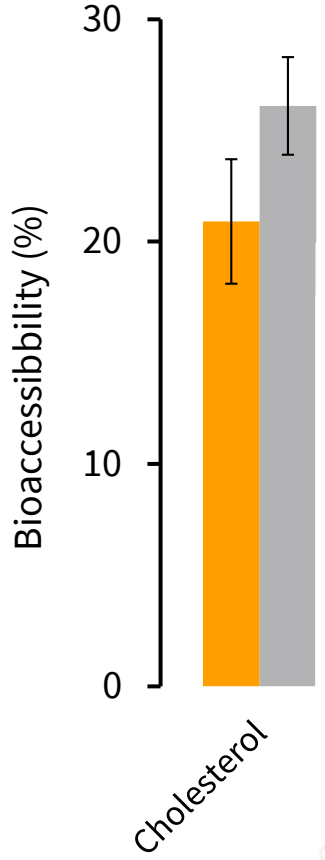
STEROL BIOACCESSIBILITY



STEROL BIOACCESSIBILITY



STEROL BIOACCESSIBILITY



GL + CE (0.075 U/mL) GL + CE (2 U/mL)

Comparison with previous studies

Blanco-Morales et al. (2018)

Without GL or CE

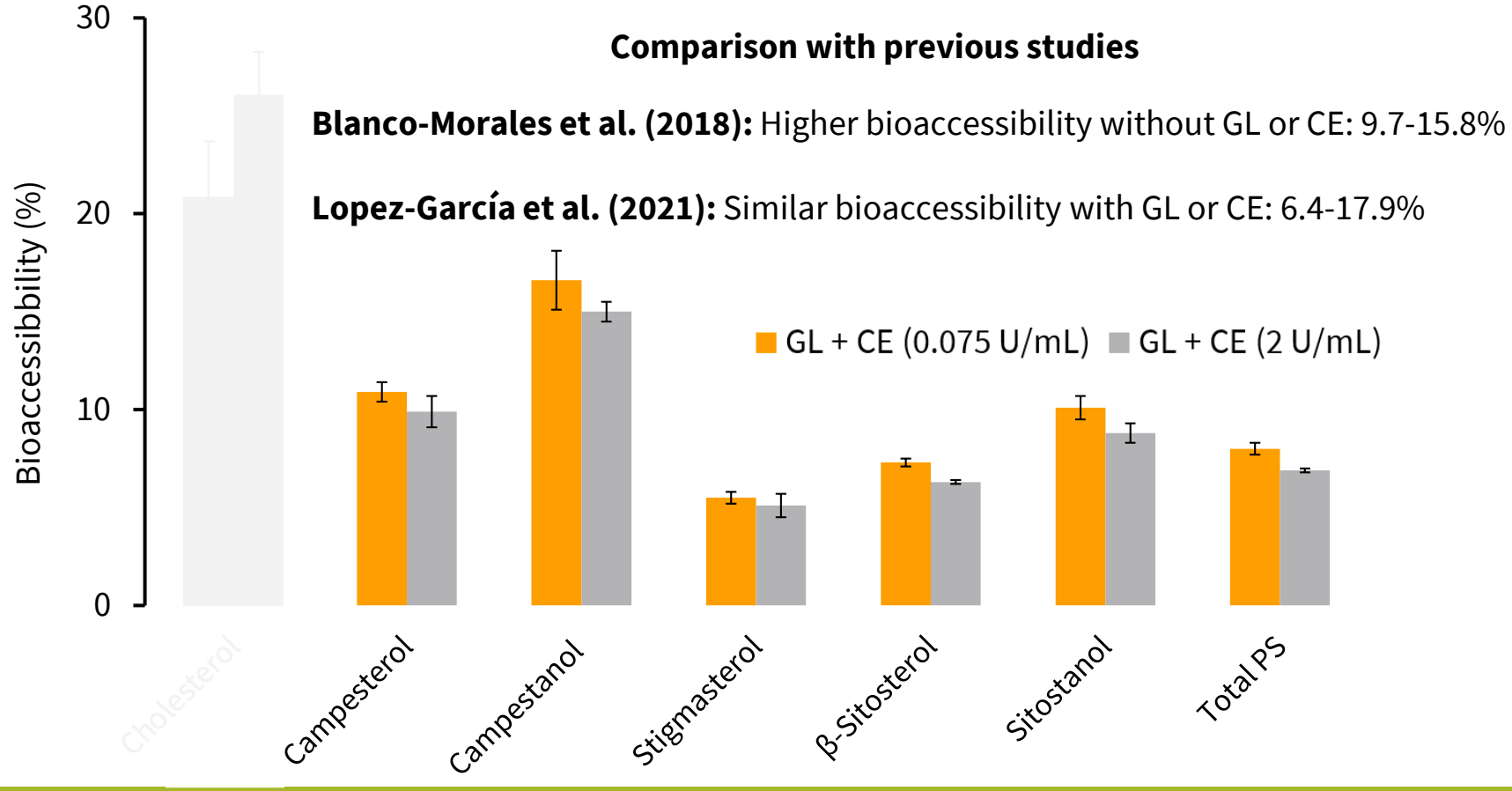
Higher bioaccessibility: 37.7%

Lopez-García et al. (2021)

Similar bioaccessibility with GL: 27.7%

Non-quantifiable with CE

STEROL BIOACCESSIBILITY



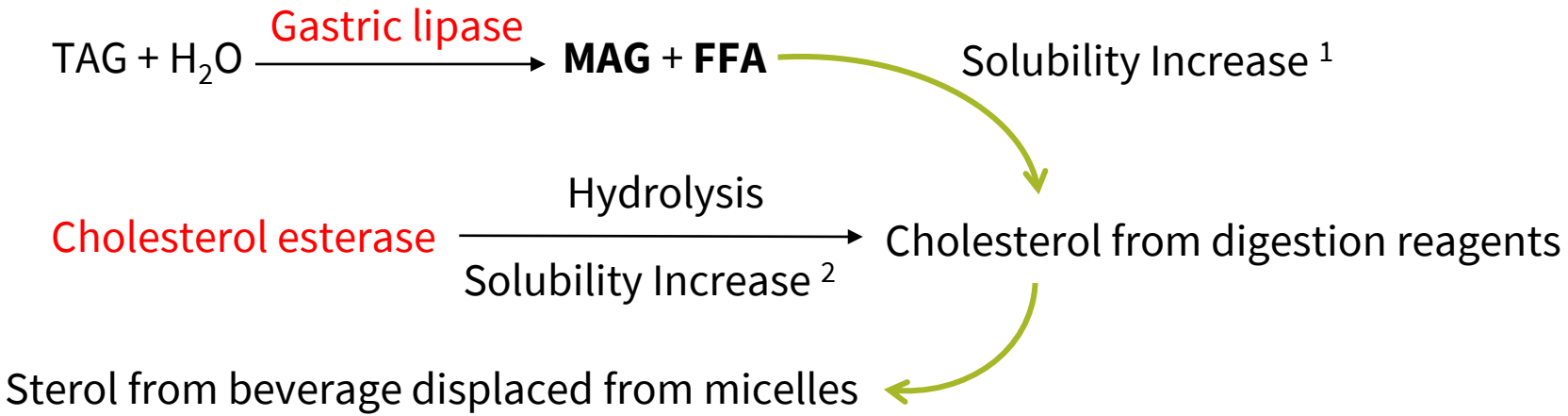
Comparison with previous studies

Blanco-Morales et al. (2018): Higher bioaccessibility without GL or CE: 9.7-15.8%

Lopez-García et al. (2021): Similar bioaccessibility with GL or CE: 6.4-17.9%

STEROL BIOACCESSIBILITY

Why is sterol bioaccessibility reduced?



TAG: triacylglycerols: MAG: monoacylglycerols; FFA: free fatty acids

[1] Nagao et al. Biosci Biotechnol Biochem, 2013, 77, 1055–1060; [2] Nissinen et al. Am J Physiol, 2002, 282, G1009–G1015.

STEROL BIOACCESSIBILITY

Why does gastric lipase allow cholesterol quantification?

TAG: triacylglycerols: MAG: monoacylglycerols; FFA: free fatty acids

CONCLUSIONS

The INFOGEST method considering the use of gastric lipase and cholesterol esterase is an adequate protocol for the evaluation of sterol bioaccessibility since reproduces more faithfully the physiological gastrointestinal conditions

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THANKS FOR YOUR ATTENTION

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