

Gastric lipase and cholesterol esterase in the INFOGEST model: evaluation of sterol bioaccessibility in plant sterol-enriched wholemeal rye bread

Nerea Faubel

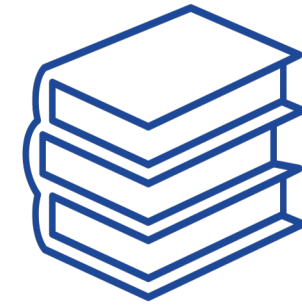
Mussa Makran, Amparo Alegría, Antonio Cilla, Reyes Barberá & Guadalupe Garcia-Llatas

Nutrition and Food Science Area, Faculty of Pharmacy, University of Valencia, Spain

BIONUTEST research group

This study is part of the project PID2019-104167RB-I00 funded by MCIN/AEI/10.13039/501100011033

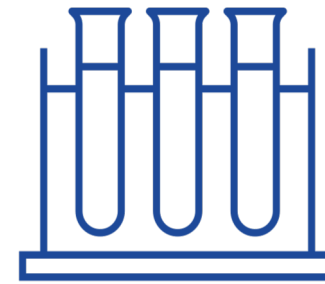
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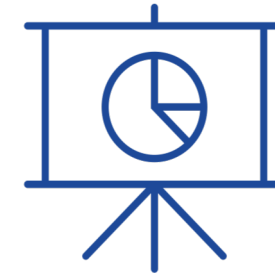
INTRODUCTION



OBJECTIVE



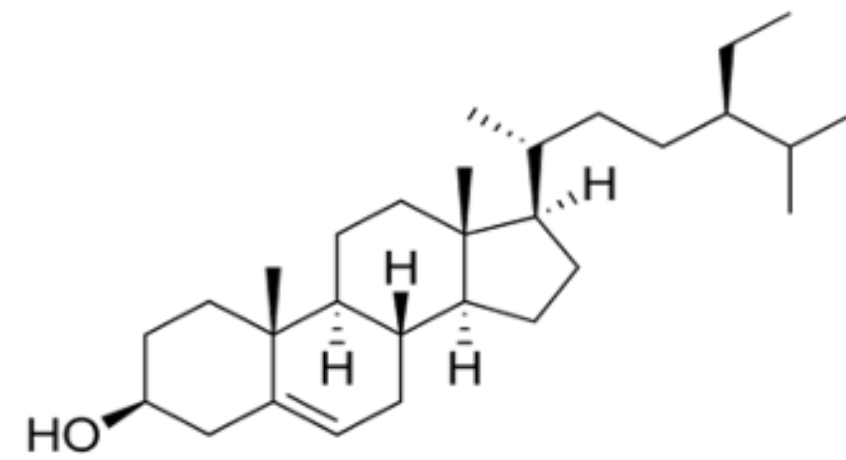
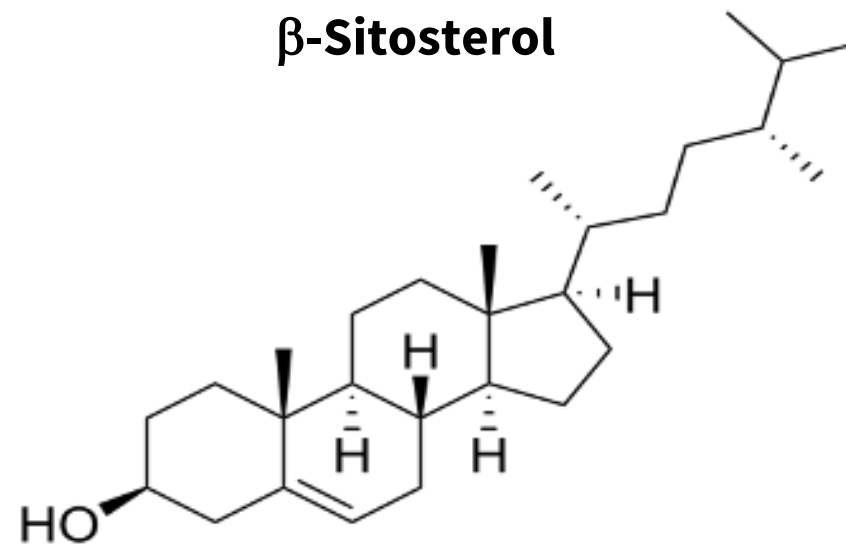
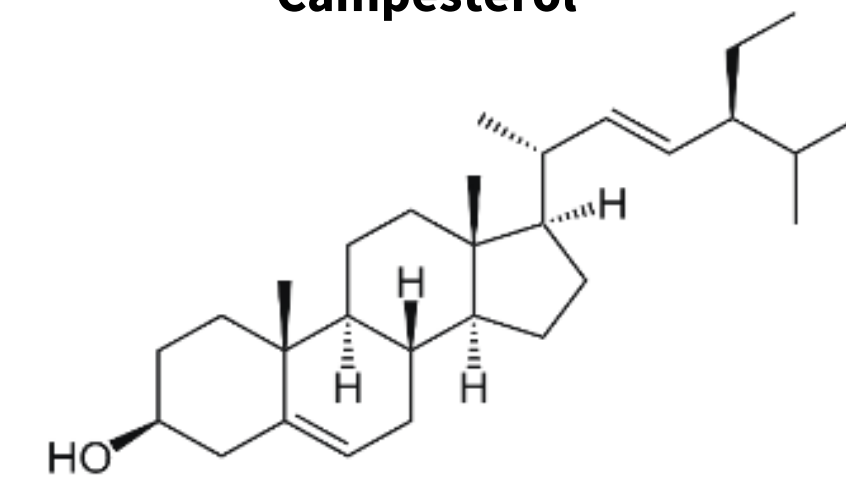
MATERIALS AND METHODS

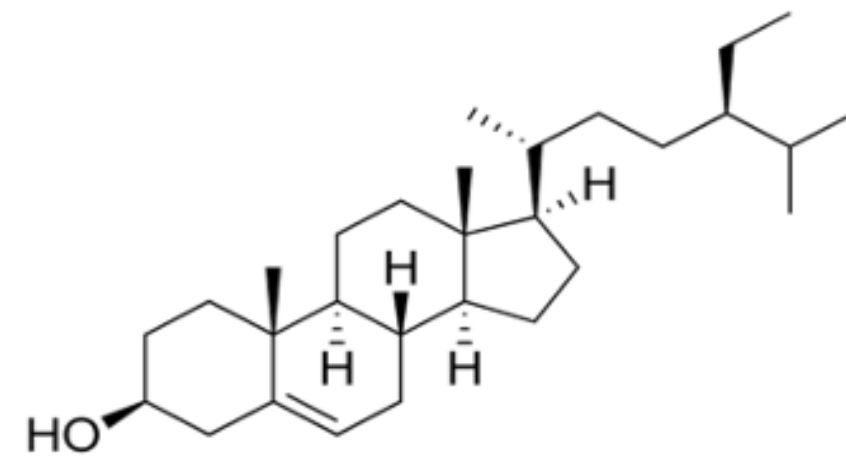
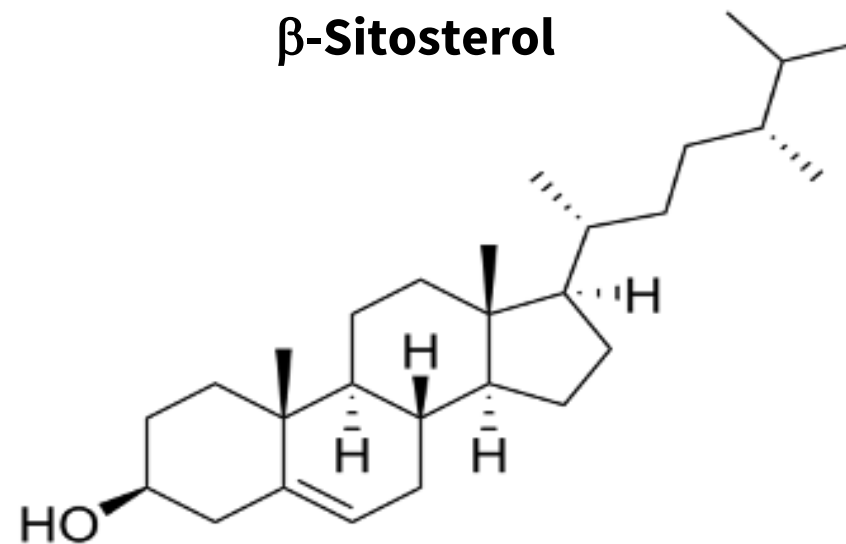


RESULTS AND DISCUSSION

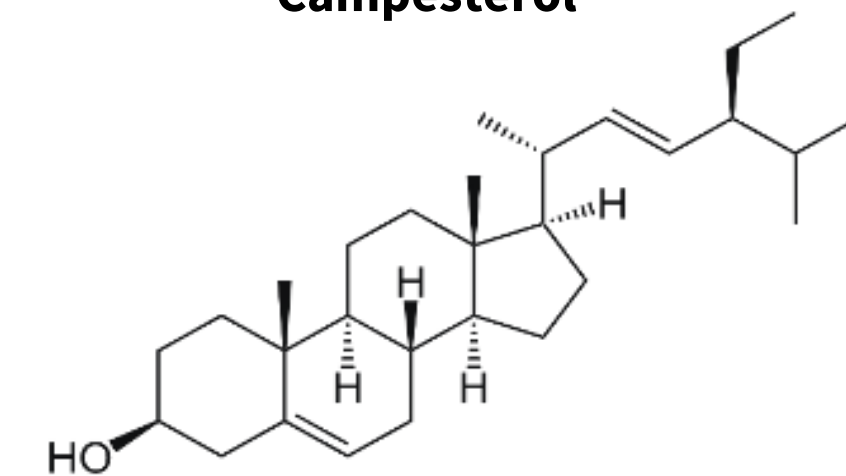


CONCLUSION

 **β -Sitosterol****Campesterol****Stigmasterol****Plant sterols**

 β -Sitosterol

Campesterol



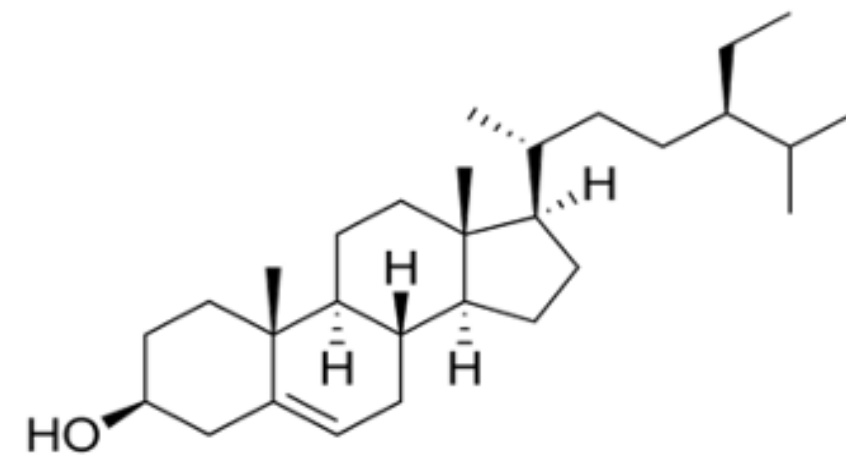
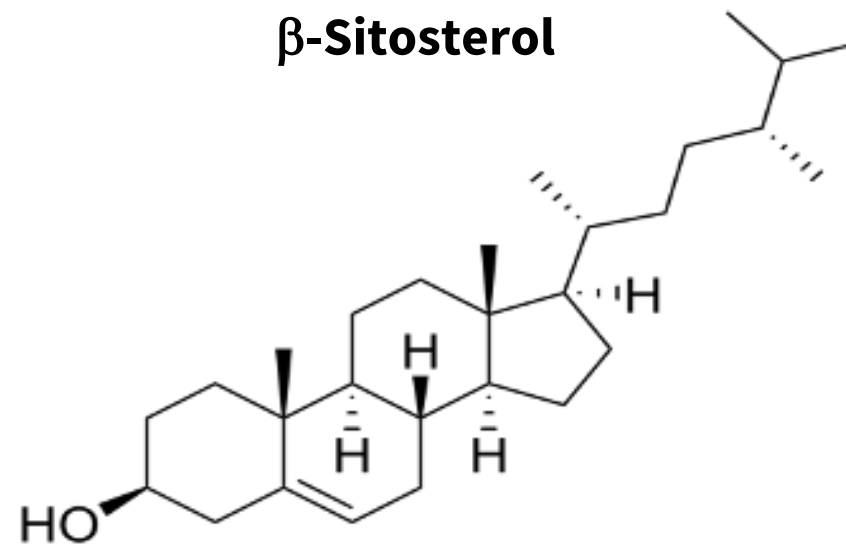
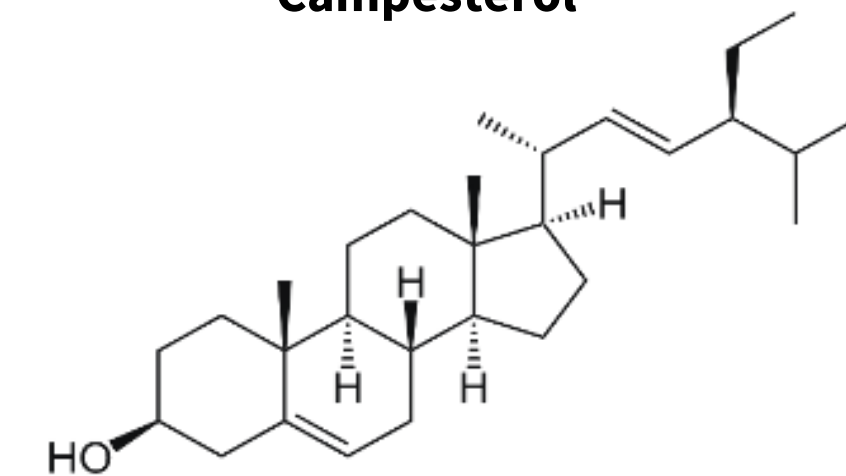
Stigmasterol

Plant sterols

Hypocholesterolemic effect:

1.5-3 g PS/day

⇓ LDL-c: 7-12.5%

**β-Sitosterol****Campesterol****Stigmasterol**

Plant sterols

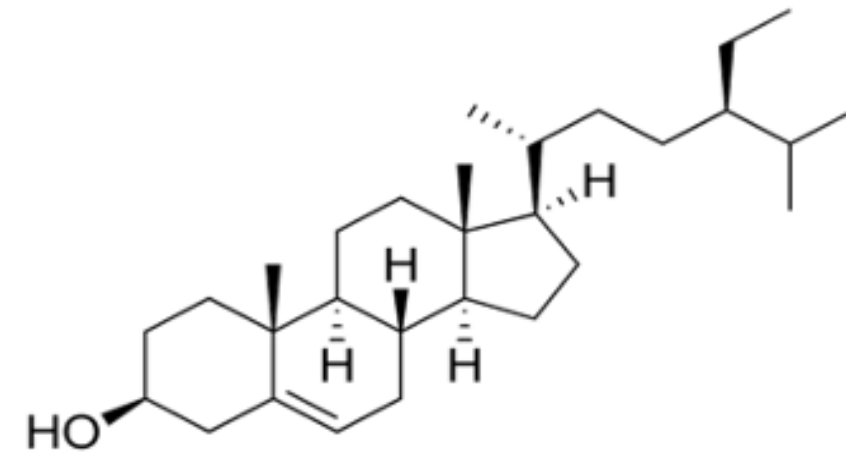
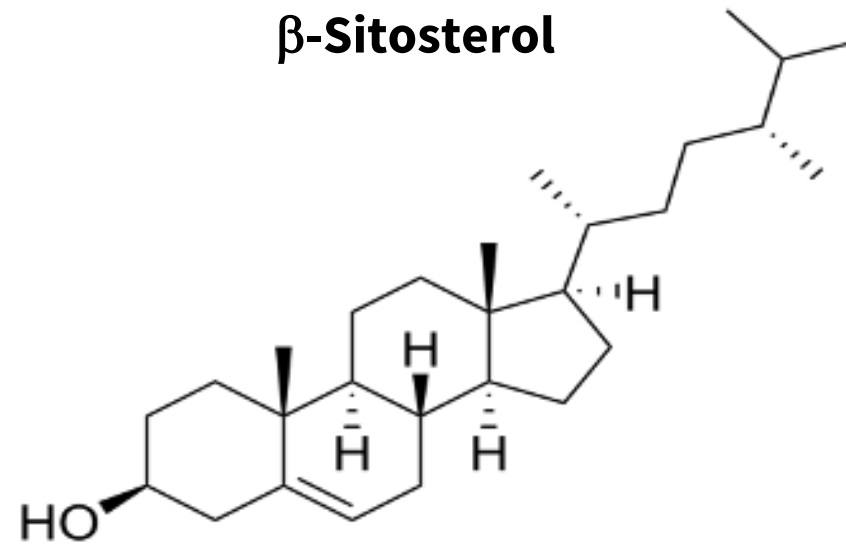
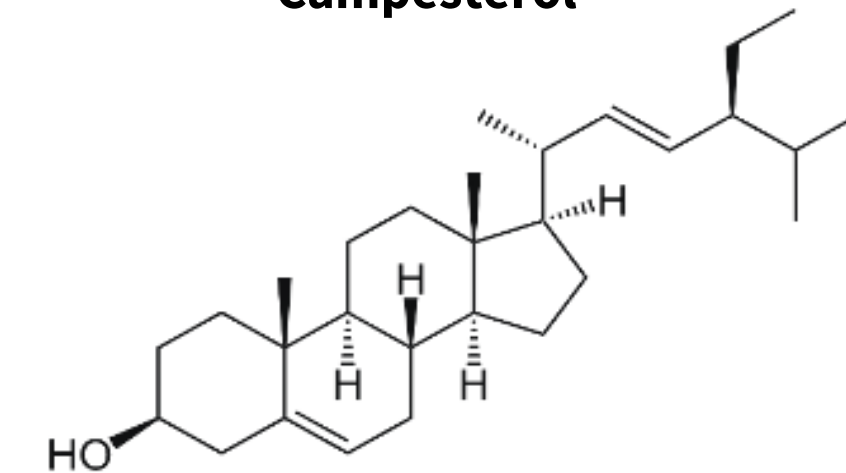
Hypocholesterolemic effect:

1.5-3 g PS/day

⇓ LDL-c: 7-12.5%

Daily intake

Western diet
276 mg/day**Vegan diet**
~1000 mg/day

 **β -Sitosterol****Campesterol****Stigmasterol**

Plant sterols

Enriched food

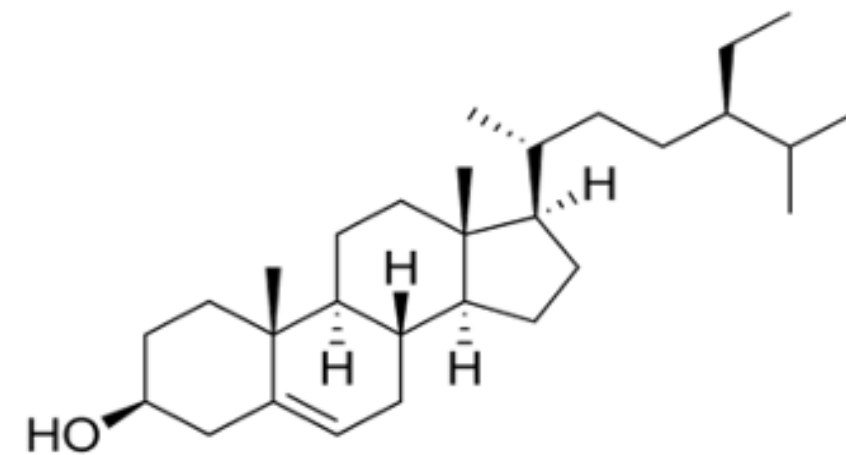
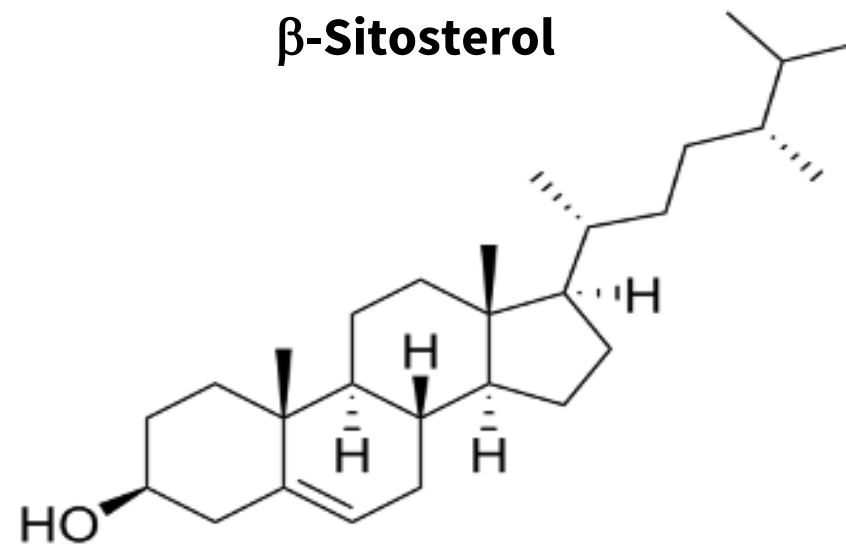
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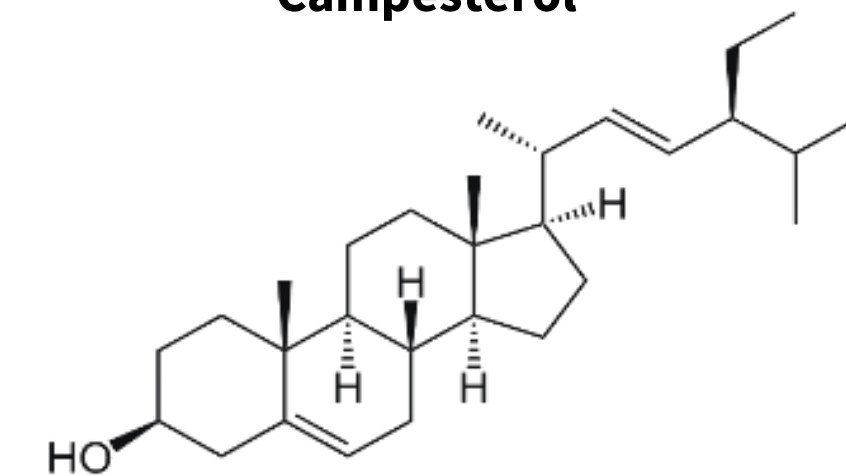
⇓ LDL-c: 7-12.5%

Daily intake

Western diet
276 mg/day**Vegan diet**
~1000 mg/dayWholemeal rye
bread

 β -Sitosterol

Campesterol



Stigmasterol

Plant sterols

Enriched food

Wholemeal rye
bread

European Union

Decision 2006/58/EC, Decision 2006/59/EC

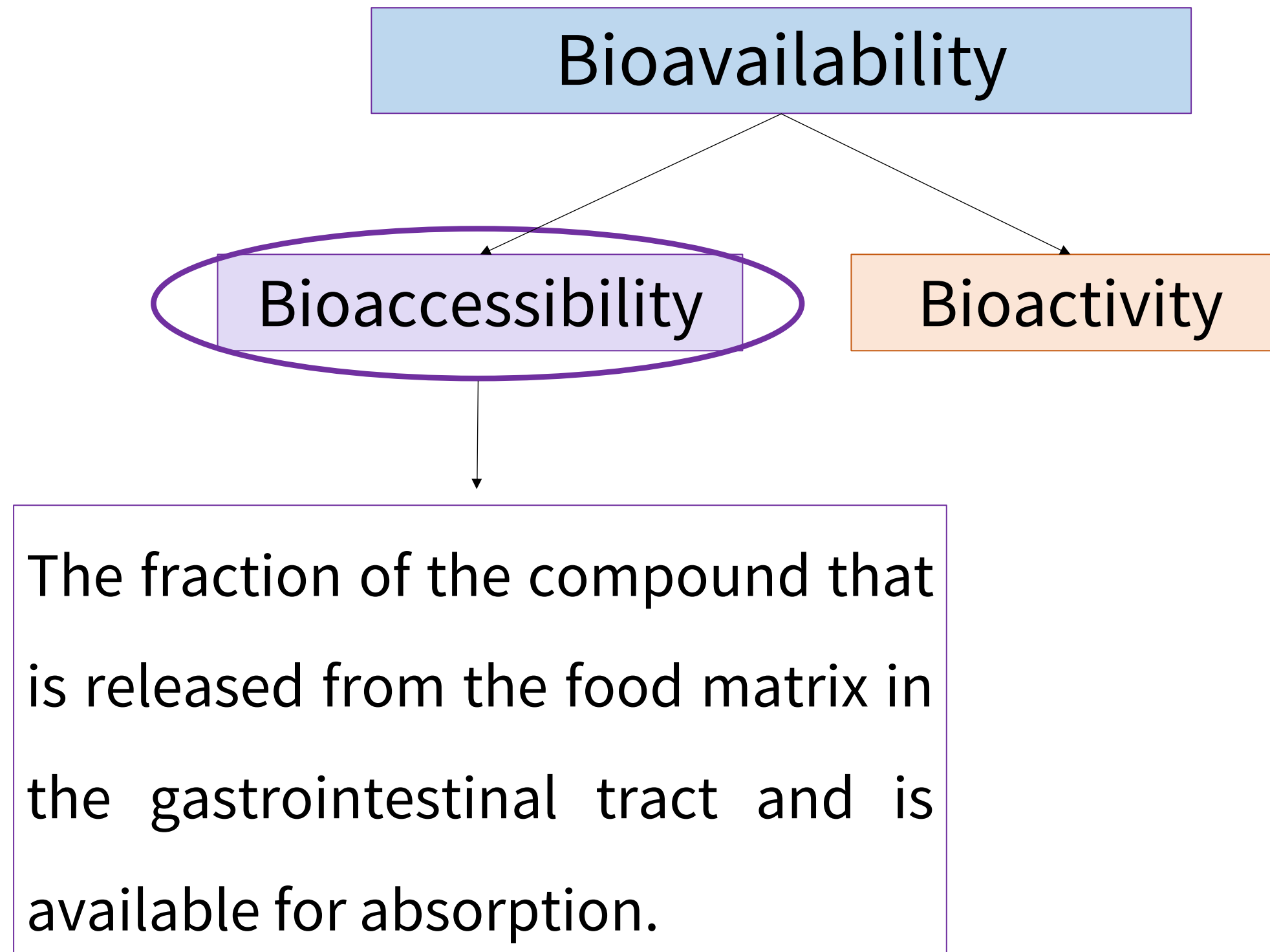
Hypocholesterolemic effect:

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Daily intake

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Bioavailability

Bioaccessibility

Bioactivity

In vitro methods

Dynamic

Semi-dynamic

Static

Monocompartimentals

Multicompartimentals

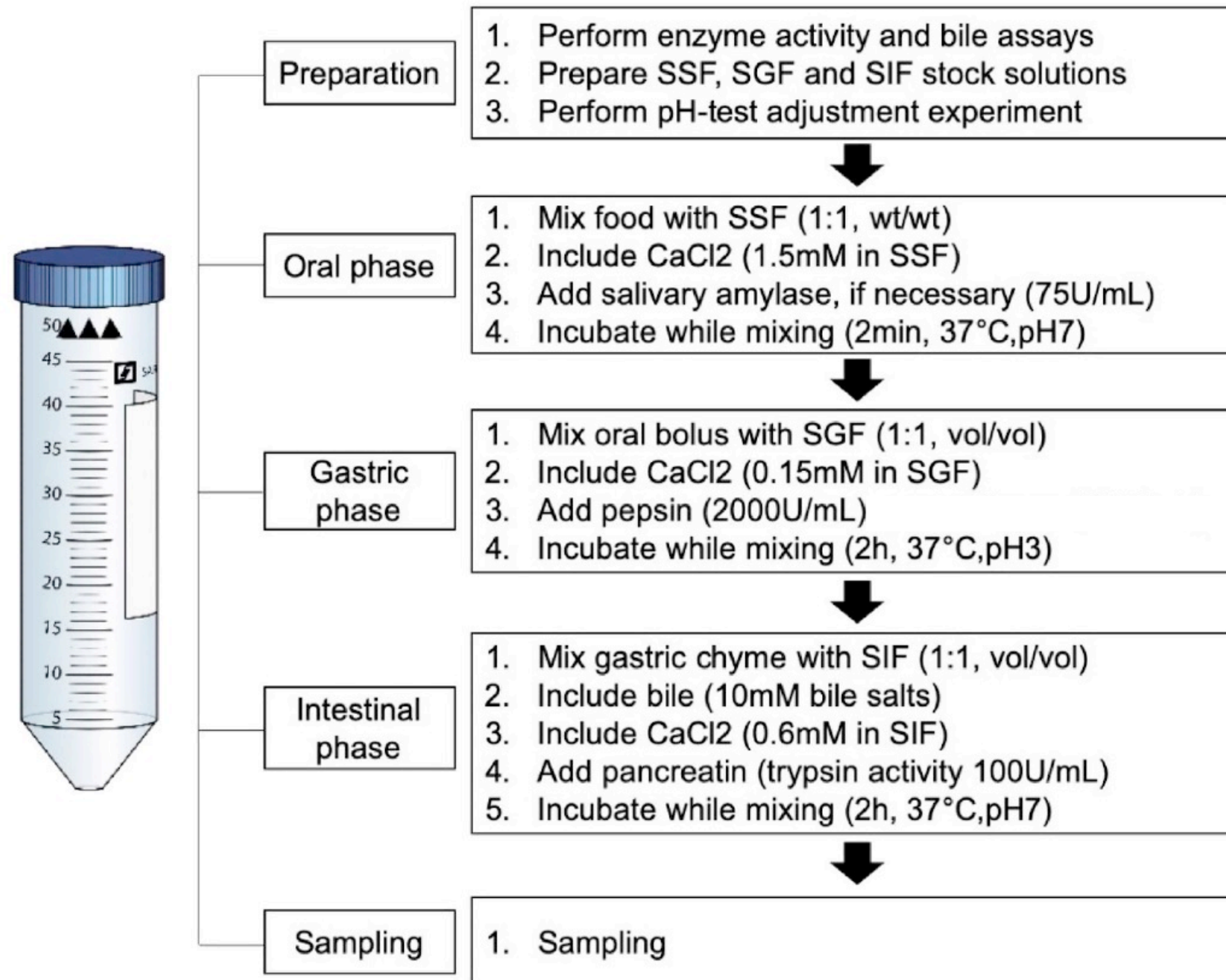


COST FA 1005 Infogest
“Improving Health Properties of
Food by Sharing our Knowledge
on the Digestive Process”

To assess the impact of gastric lipase and cholesterol esterase, as key enzymes of lipid metabolism, in the INFOGEST digestion method on plant sterol bioaccessibility in a plant sterol-enriched wholemeal rye bread.

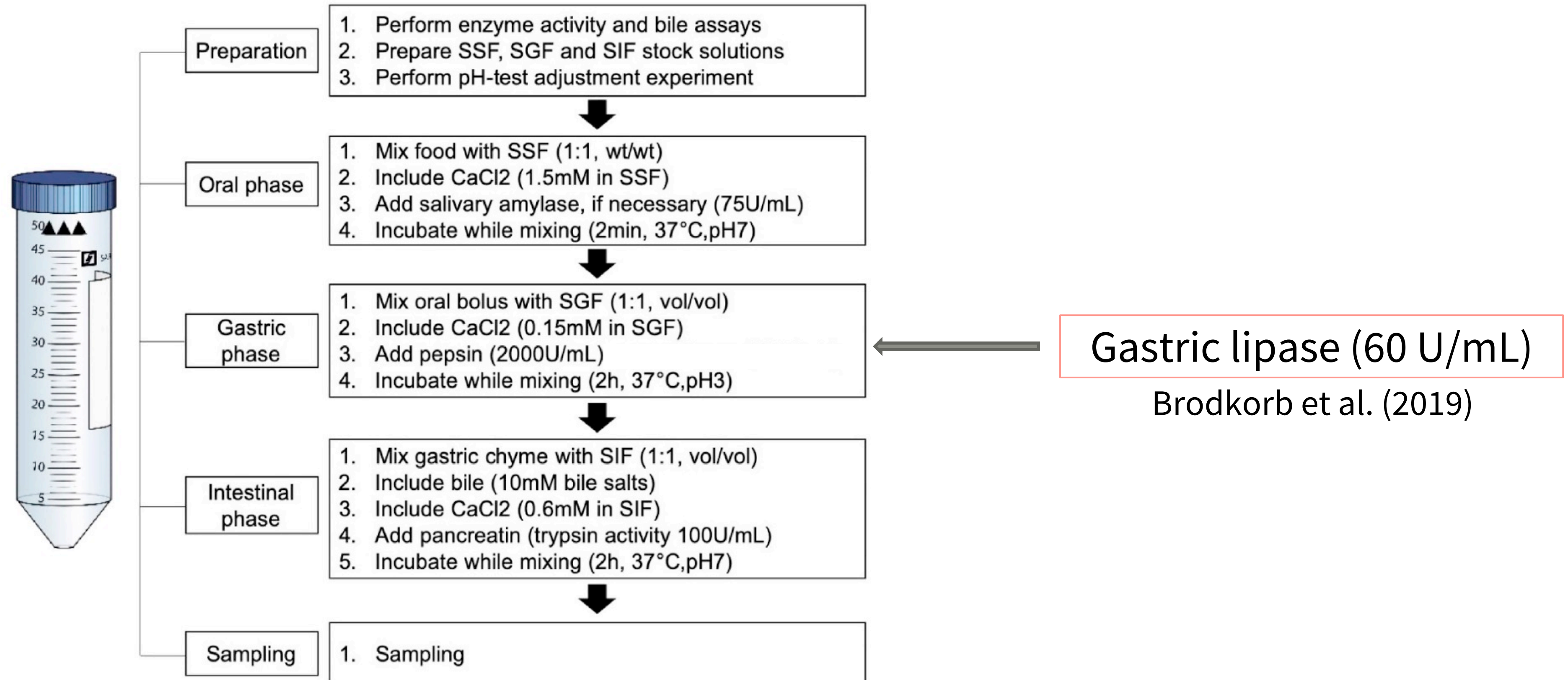
INFOGEST

Minekus et al. (2014)



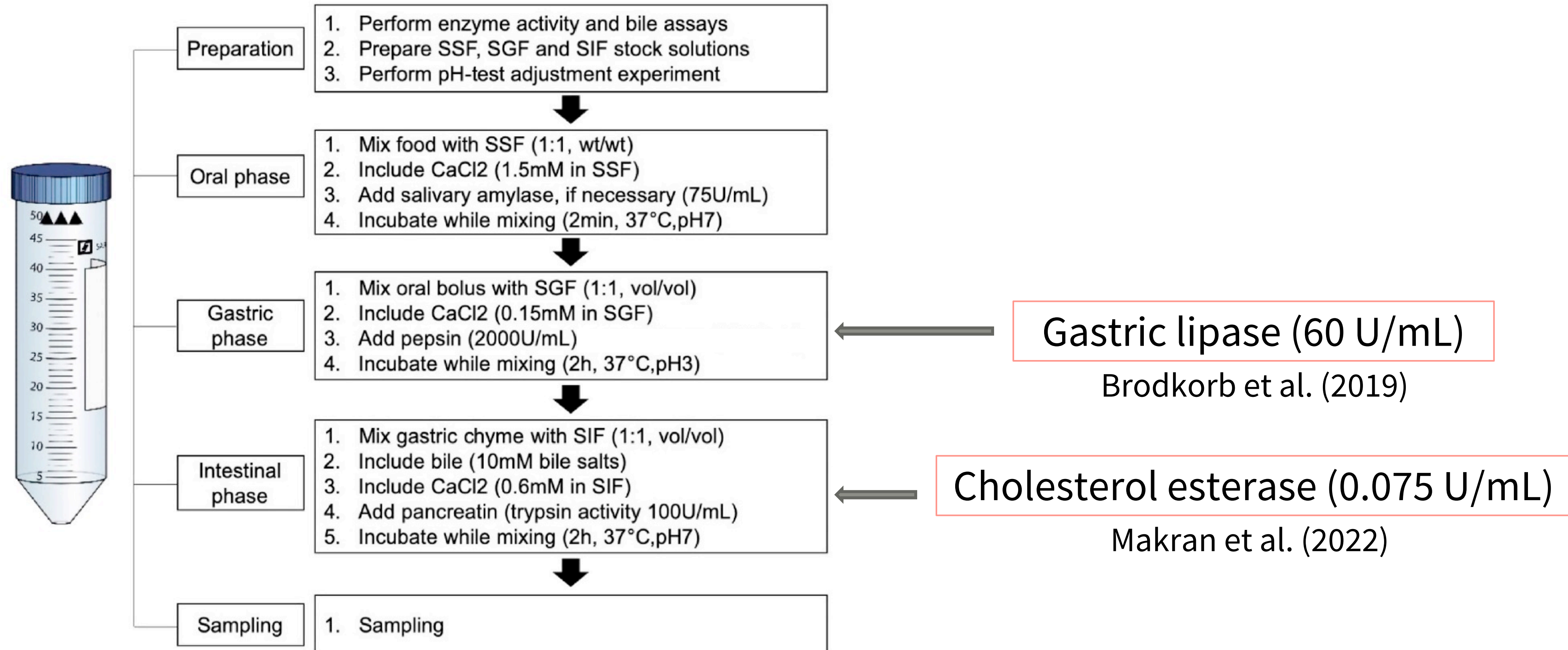
INFOGEST

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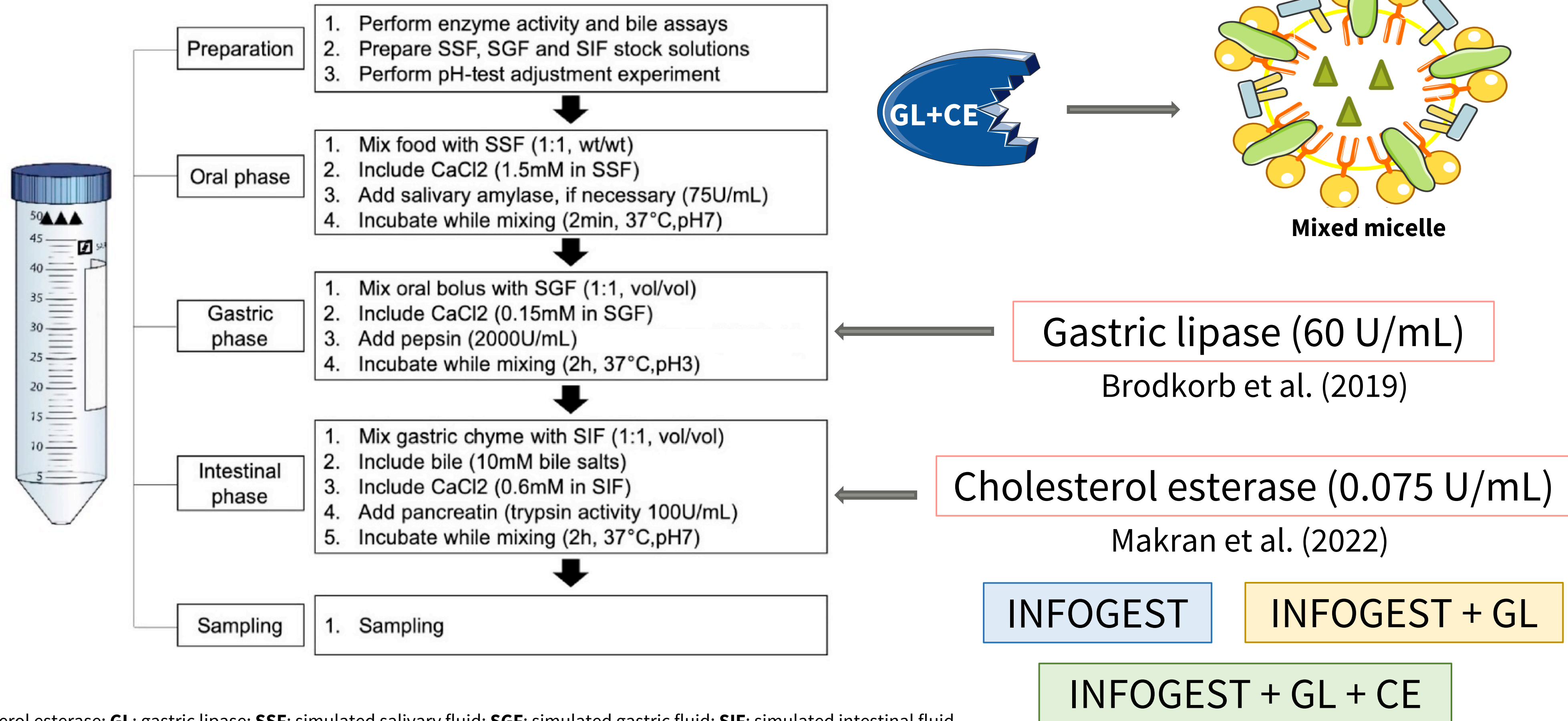
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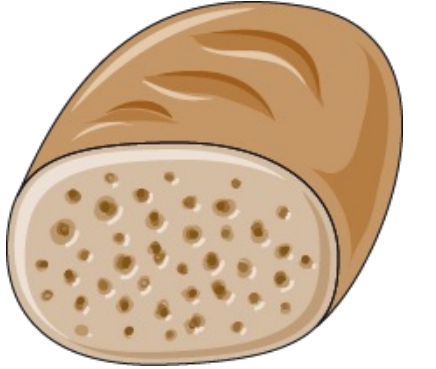
INFOGEST

Minekus et al. (2014)



Samples

- Plant sterol-enriched wholemeal rye bread fortified with an ingredient containing microencapsulated free plant sterols (1.8 g plant sterols/80 g rye bread) from tall oil.



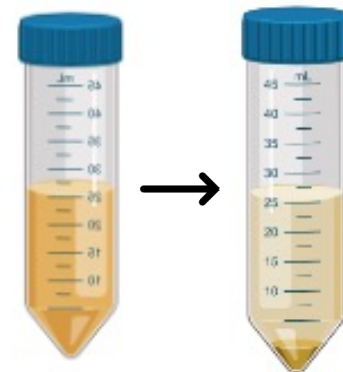
↓ Simulated
digestion

INFOGEST

INFOGEST + GL

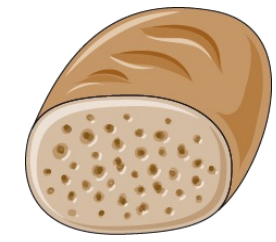
INFOGEST + GL + CE

- Bioaccessible fraction



Samples

Plant sterol determination



Rye bread



BF

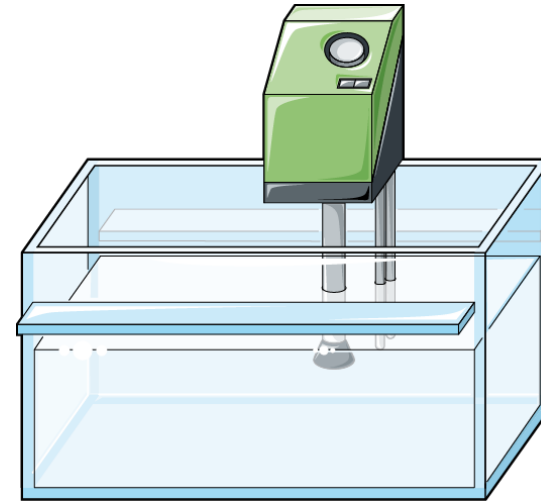
Fat extraction

Only for rye bread

Hexane:diethylether
(1:1, v/v)
H: 400 rpm/10'
C: 500 rpm/10'

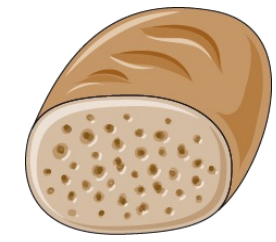
Hot saponification

Saturated KOH
80 °C/30'



Unsaponifiable extraction

Ultrapure water
Cyclohexane
400 rpm/10'

SamplesPlant sterol determination

Rye bread



BF

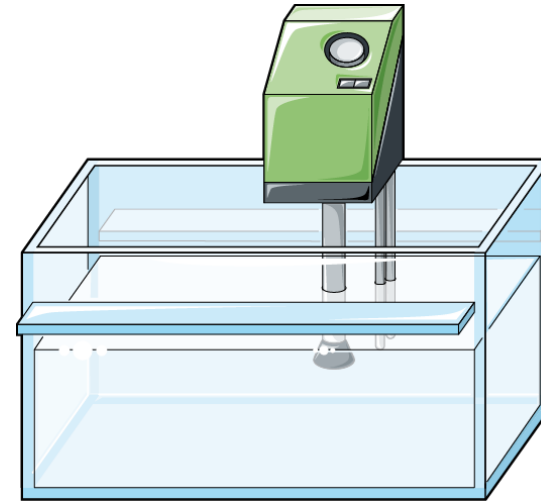
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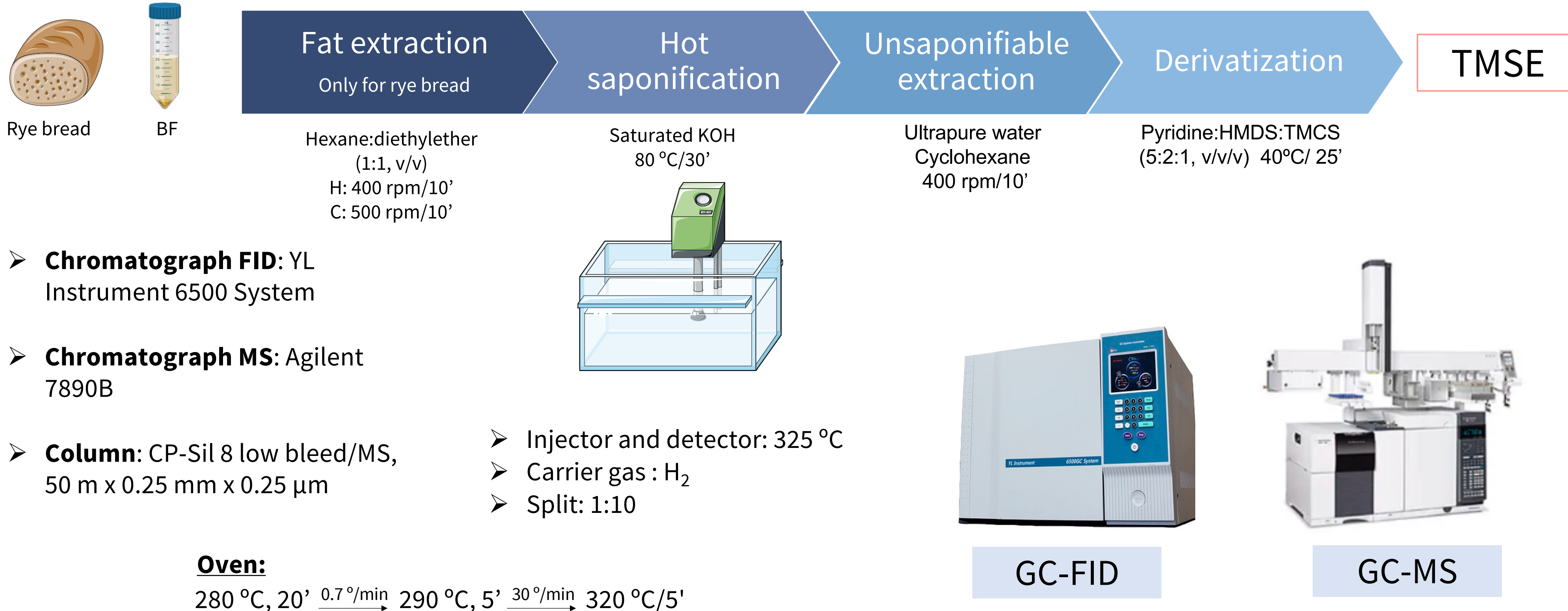
Unsaponifiable
extraction

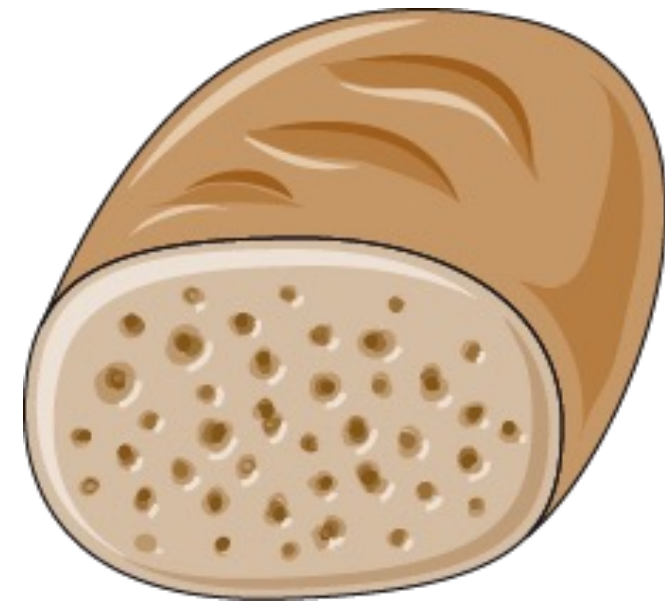
Ultrapure water
Cyclohexane
400 rpm/10'

Derivatization

Pyridine:HMDS:TMCS
(5:2:1, v/v/v) 40°C/ 25'

TMSE

SamplesPlant sterol determination

Plant sterol contents in rye bread

1.8 g PS/80 g

β -Sitosterol

Sitostanol

Campesterol

Campestanol

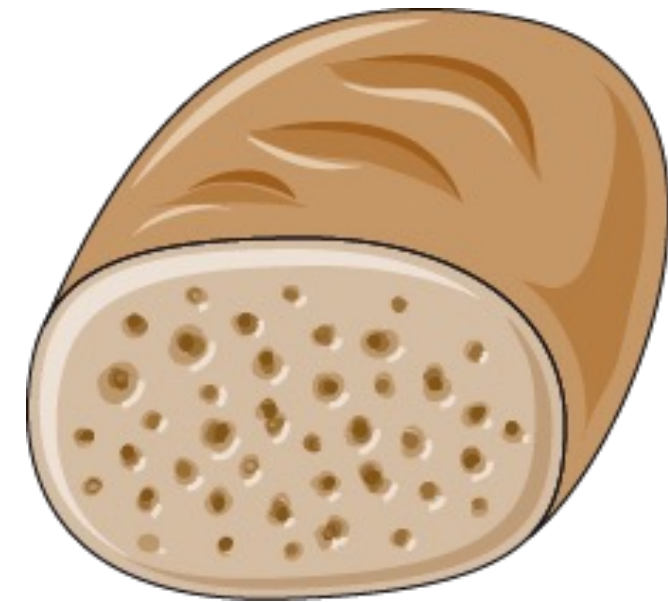
Δ^5 -Avenasterol

Δ^7 -Stigmastenol

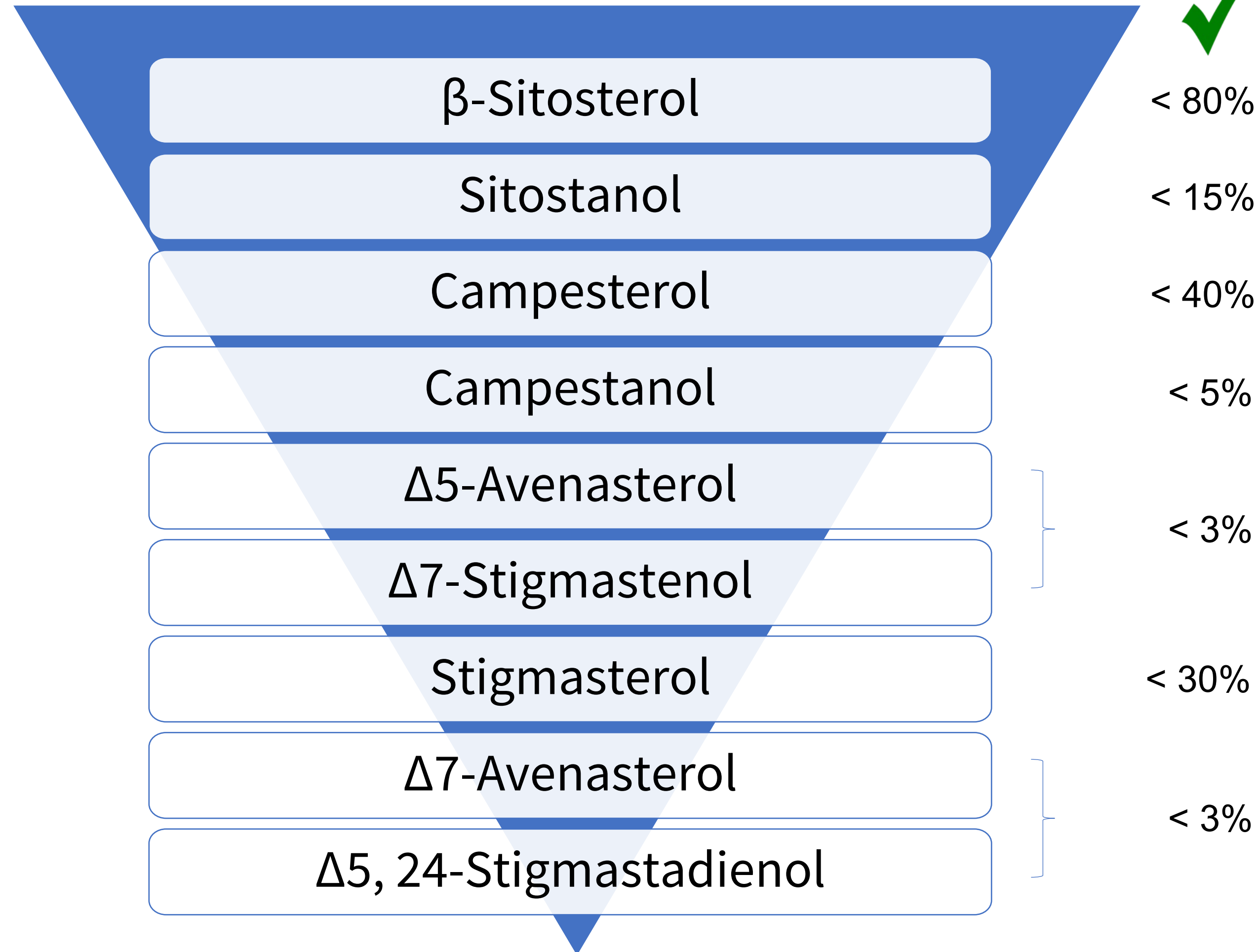
Stigmasterol

Δ^7 -Avenasterol

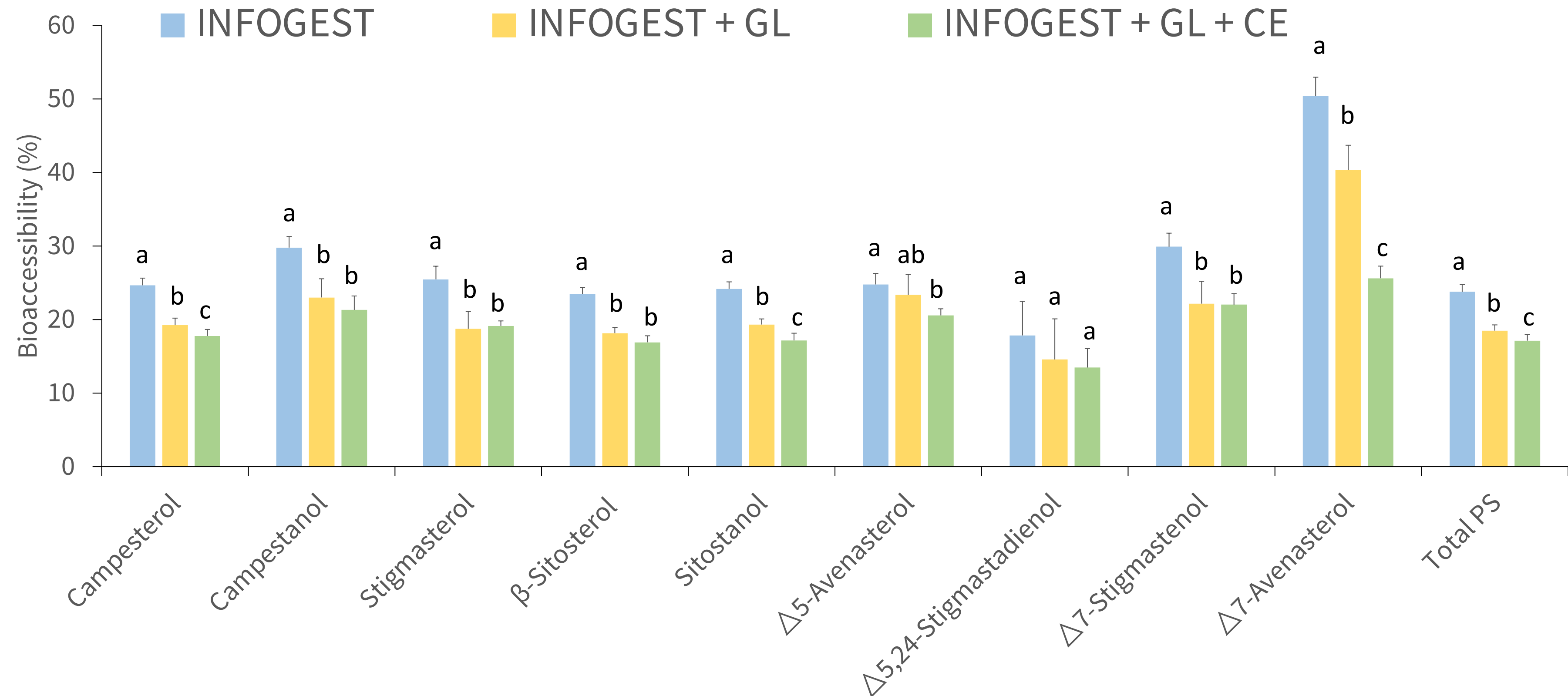
$\Delta^5, 24$ -Stigmastadienol

Plant sterol contents in rye bread

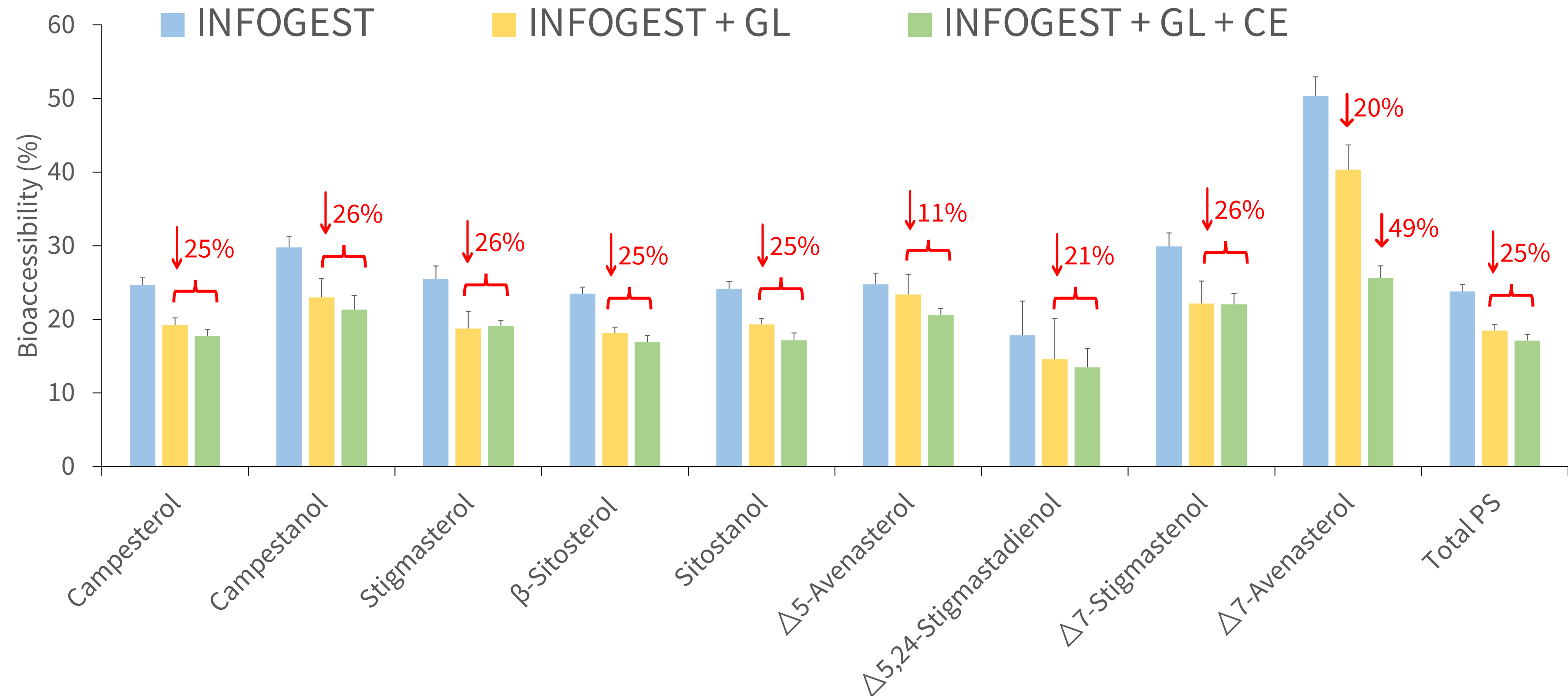
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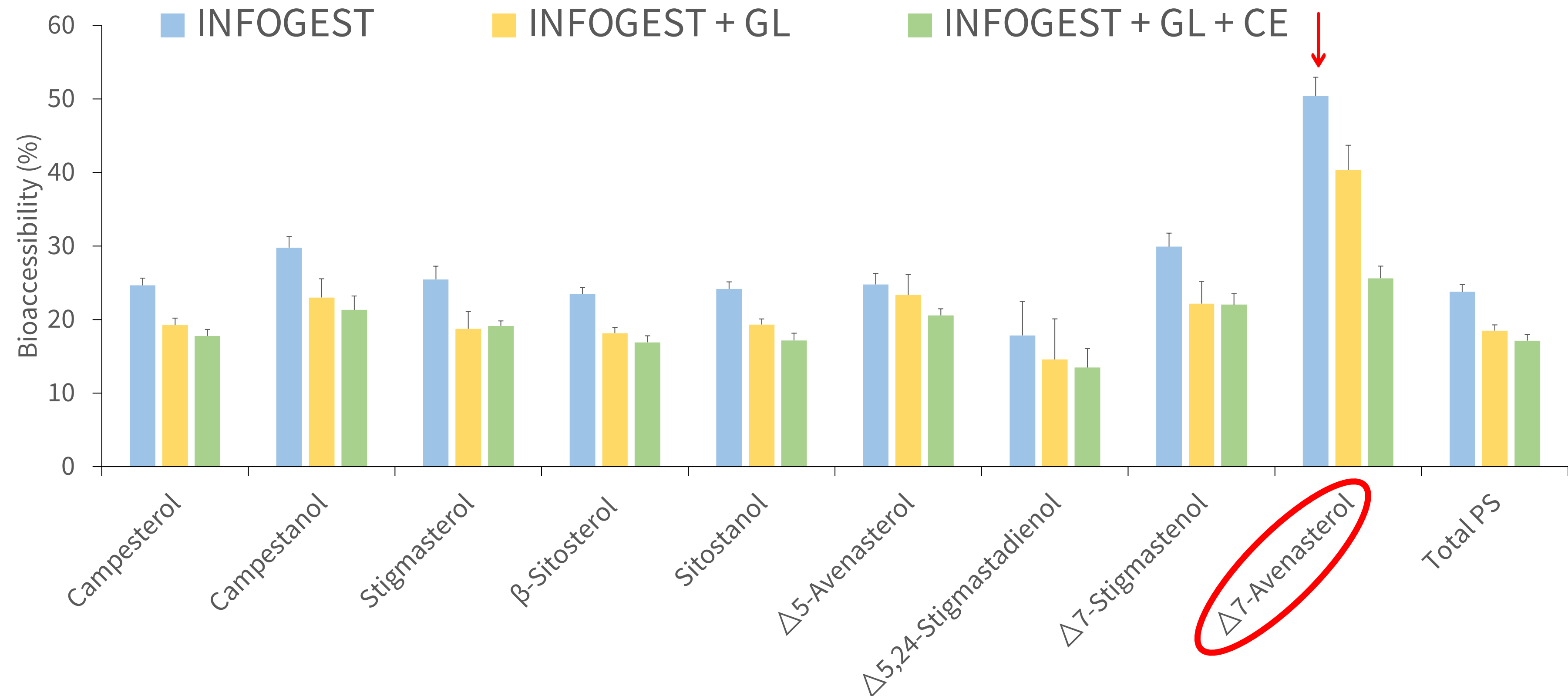
Plant sterol bioaccessibility in rye bread



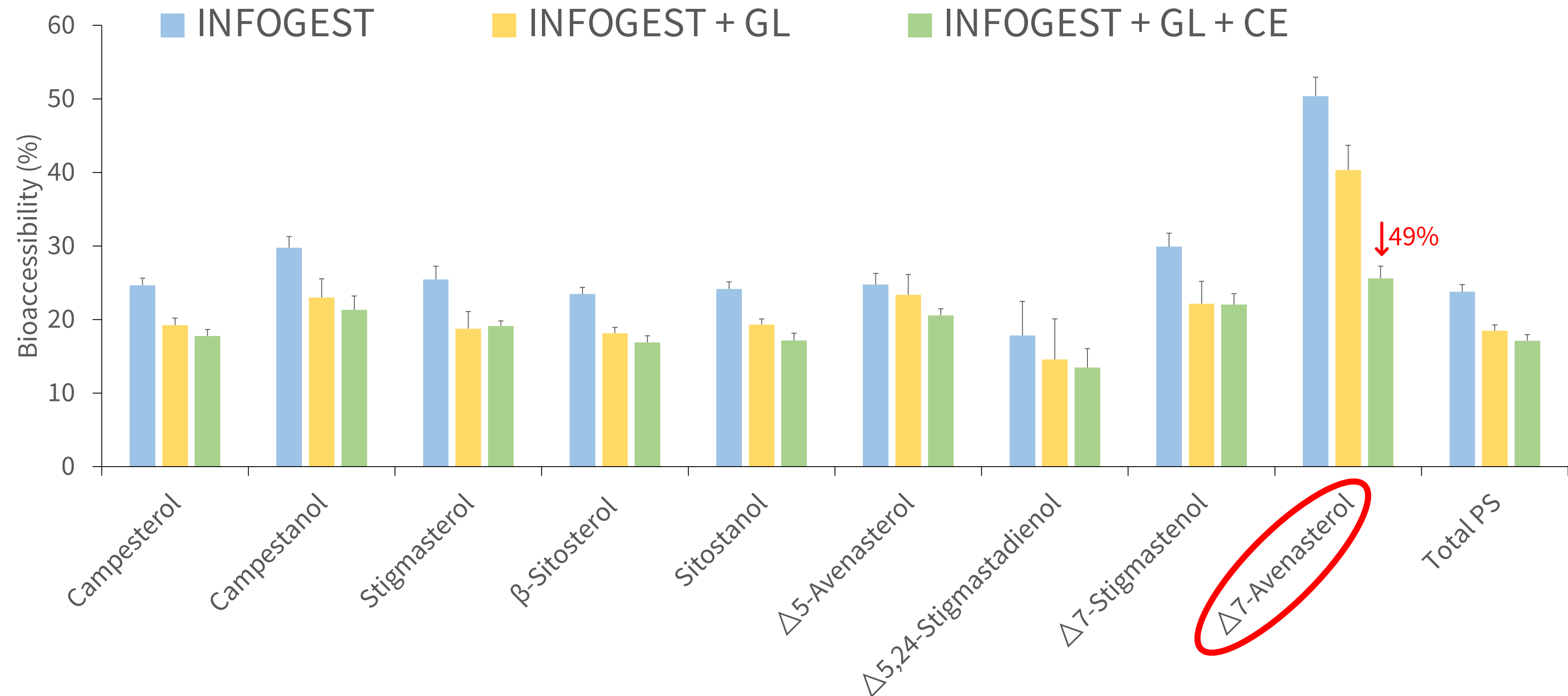
Plant sterol bioaccessibility in rye bread



Plant sterol bioaccessibility in rye bread

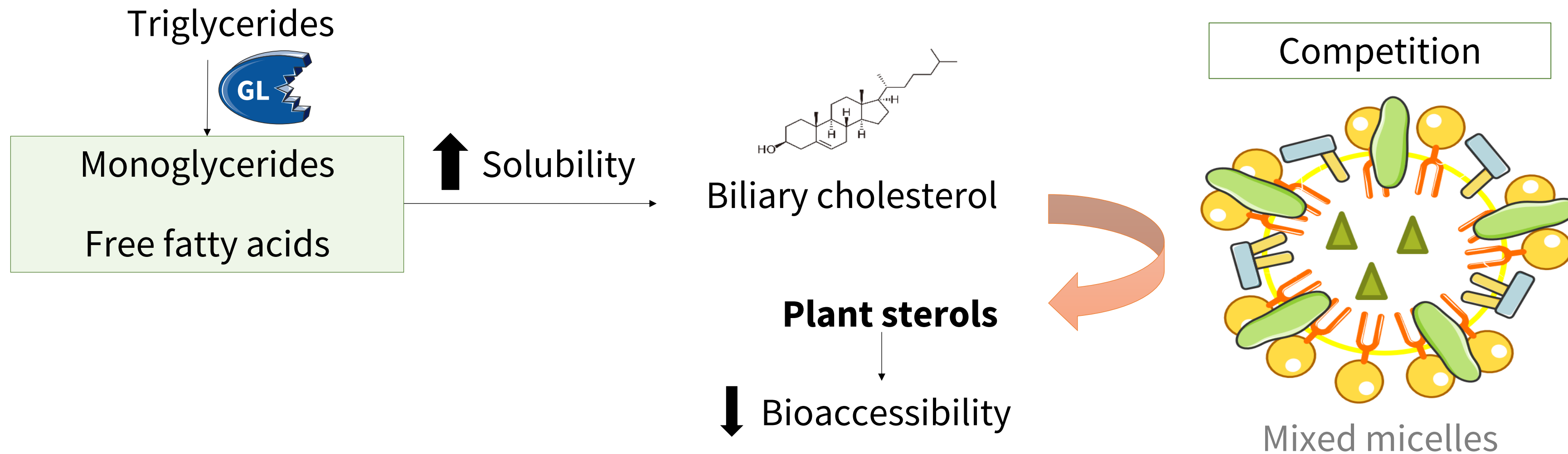


Plant sterol bioaccessibility in rye bread



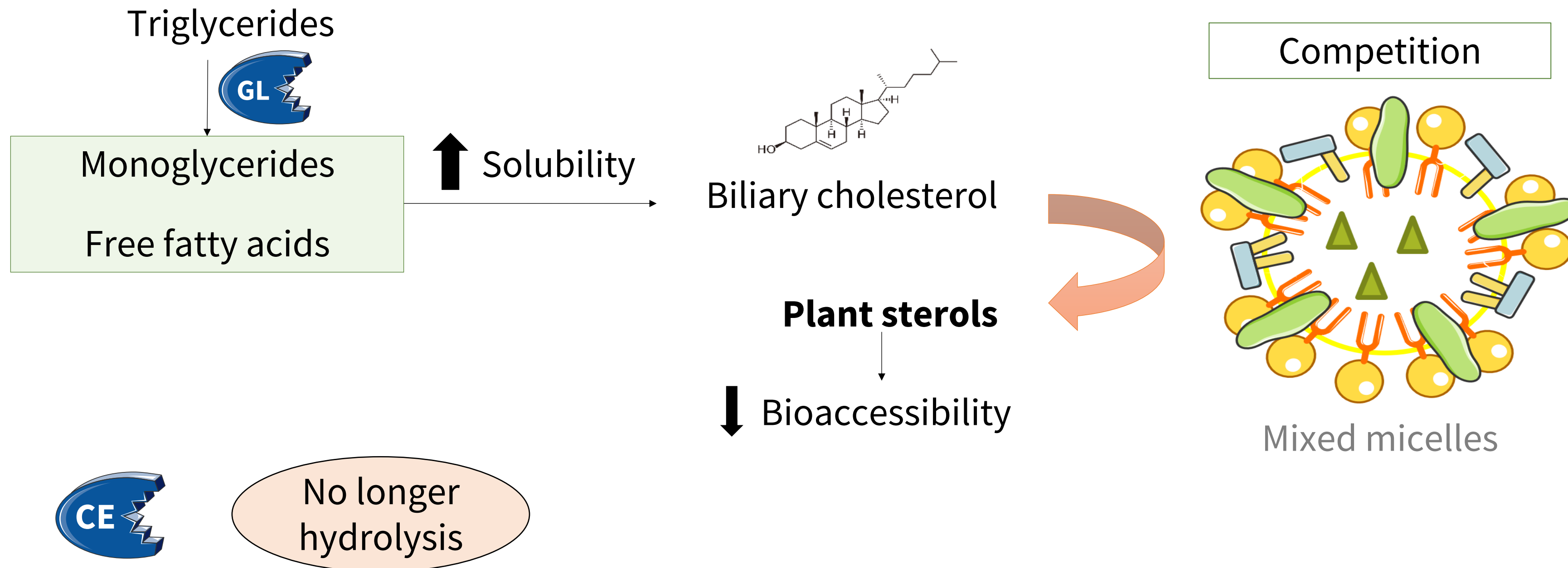
GL contribution
to TG lipolysis

Solid foods → **10%**



GL contribution
to TG lipolysis

Solid foods → **10%**



The use of gastric lipase and cholesterol esterase implies a closer approach to *in vivo* conditions, and we propose their inclusion in the INFOGEST model for the evaluation of the bioaccessibility of plant sterols and other lipidic bioactive compounds.

Gastric lipase and cholesterol esterase in the INFOGEST model: evaluation of sterol bioaccessibility in plant sterol-enriched wholemeal rye bread

¡Thank you for your attention!

Nerea Faubel (nefaufe@alumni.uv.es)