Standardized in vitro static digestion for diverse nutrients: understanding the consequence of food parameters on digestion kinetics

Commonly used acronym: *Static digestion protocol*
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SCOPE OF THE METHOD

The Method relates to	Human health
The Method is situated in	Basic Research, Translational - Applied Research
Type of method	In vitro - Ex vivo
This method makes use of	Animal derived cells / tissues / organs
Species from which cells/tissues/organs are derived	Porcine, bovine
Type of cells/tissues/organs	Enzymes

DESCRIPTION

Method keywords

in vitro digestion

static digestion

enzymatic hydrolysis

Scientific area keywords

in vitro
digestion
nutrient hydrolysis
bioaccessibility

Method description

We study the influence of food parameters on the digestive kinetics of diverse nutrients throughout the upper gastrointestinal tract. For this, we use a static *in vitro* digestion protocol based on the standardized, consensus method recommended by the INFOGEST consortium. Briefly, the food is first mixed with simulated salivary fluids to simulate the dilution of the oral compartment. Hereafter, the gastric phase is simulated by lowering the pH to 3 and adding gastric digestive fluids and enzymes (e.g. pepsin and gastric lipase). Finally, the pH is increased to pH 7 and small intestinal fluids (e.g. bile salts) and enzymes (e.g. (chymo)trypsin, pancreatic lipase and □-amylase) are added to simulate the small intestinal phase. Samples are taken as function of digestion time to study the kinetic evolution of nutrient hydrolysis and metabolite formation throughout the upper gastrointestinal tract. Quantification of the digestive metabolites is mostly done by chromatographic techniques. Our analytical platform allows characterization of starch, lipid and protein macronutrient digestion as well as bioaccessibility of a range of micronutrients (minerals, carotenoids, etc.). Besides, we structurally characterize our digested food during digestion by the evaluation of particle size, microstructure and/or particle charge.

Lab equipment

- Titrino,
- Spectrophotometer,
- Water bath,
- pH meter,
- Vortex,
- Overhead shaker or rotator,
- Incubator at 37 °C,
- Falcon tubes,
- Beakers,

- Volumetric flasks,
- Pipettes and tips,
- Magnetic mixer,
- Centrifuge etc.

Optional:

- HPLC,
- GC,
- ICP-OES,
- Particle sizing equipment,
- Microscope,
- Particle charge measuring device.

Method status

Published in peer reviewed journal

PROS, CONS & FUTURE POTENTIAL

Advantages

- High throughput,
- High reproducibility,
- Ease of use,
- No ethical constraints.

Challenges

Not taking into account among others dynamic secretions of digestive enzymes or fluids, pH changes, gastric emptying, metabolite absorption, fermentation in the large intestine; for this more complex (semi-)dynamic *in vitro* protocols should be used.

REFERENCES, ASSOCIATED DOCUMENTS AND OTHER INFORMATION

References

Verkempinck et al. (2018) – Kinetic approach to study the relation between in vitro lipid digestion and carotenoid bioaccessibility in emulsions with different oil unsaturation degree.

Pallares Pallares et al. (2019) – Process-induced cell wall permeability modulates the

in vitro starch digestion kinetics of common bean cotyledon cells.
Rousseau et al. (2019) – Zinc bioaccessibility is affected by the presence of calcium ions and degree of methylesterification in pectin-based model systems.

Associated documents

Verkempinck et al (2018a).pdf
Pallares Pallares et al (2019a) - Process-induced cell wall permeability modulates the in vitro starch digestion kinetics of common bean cotyledon cells.pdf
Rousseau et al (2019) - Zinc BAC is affected by presence of Ca and DM in pectin-based model systems.pdf

Links

Verkempinck et al. (2018)
Pallares Pallares et al. (2019)
Rousseau et al. (2019)

PARTNERS AND COLLABORATIONS

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