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# Age-optimized digestion of two high protein dairy products: Gastric *in vitro* semi-dynamic digestion model of adult vs older adults

Shannon Gwala<sup>1</sup>, Anaïs Lavoisier<sup>2</sup>, Martine Morzel<sup>2</sup>, Didier Dupont<sup>2</sup>, André Brodkorb<sup>1</sup>

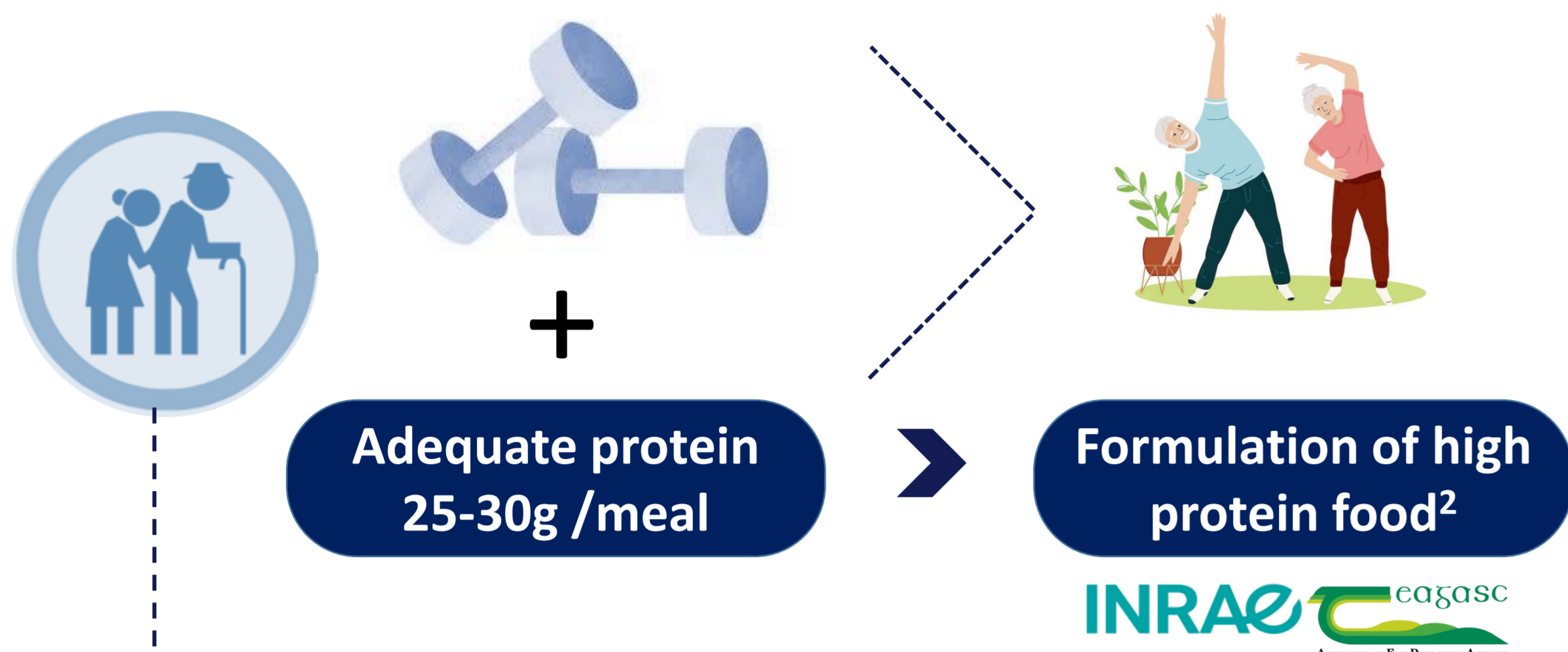
<sup>1</sup>TEAGASC Food Research Centre, Moorepark Fermoy, Ireland; <sup>2</sup>INRAE, UMR STLO, Institut Agro, France



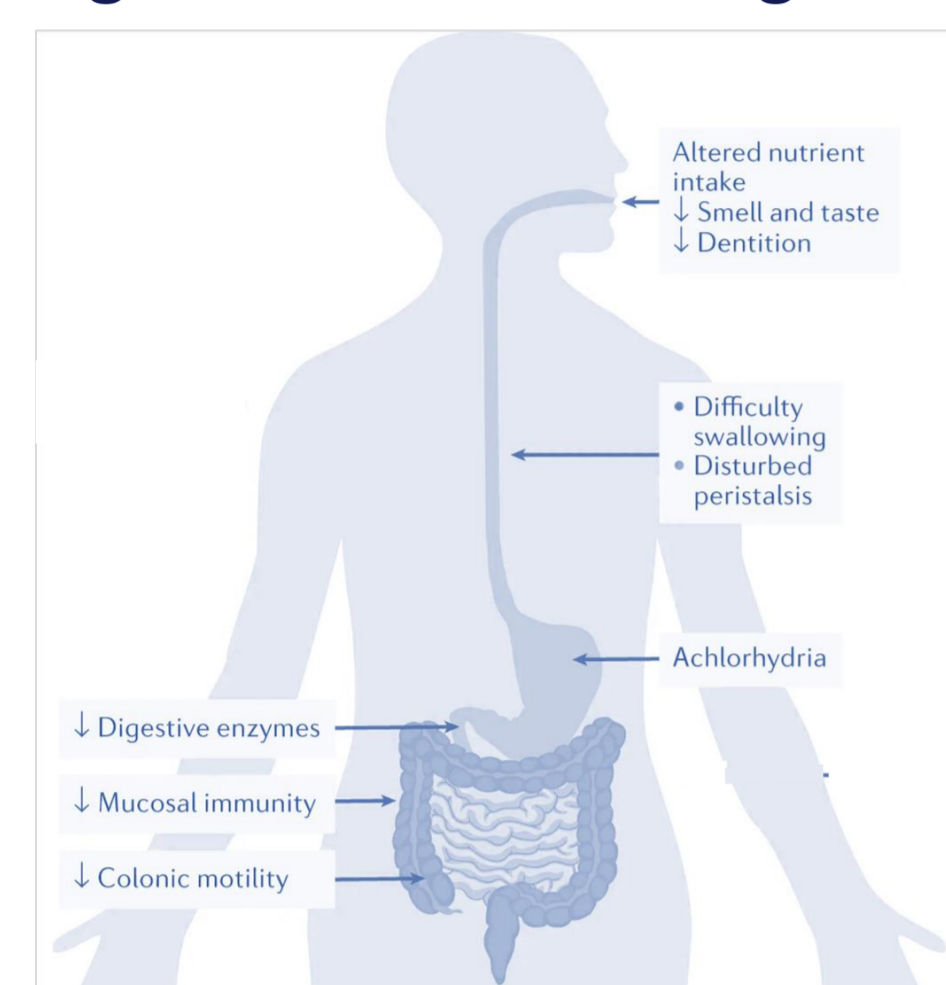
shannon.gwala@teagasc.ie

## Introduction

Nutrition & exercise contribute to healthy aging<sup>1</sup>.



Age related GIT changes<sup>3</sup>



- Rational design of food targeted for older adults need to take G.I.T changes into account.
- In the older adult, the gastric phase has several significant differences.
- *In vitro* gastric semi- dynamic digestion can provide insight into these changes.

## Objectives

- To apply a physiologically relevant model to the older adult population.
- To establish differences in protein deconstruction due to application of an older adult parameters under semi-dynamic gastric conditions.

## Key message

We show the importance of applying physiologically relevant parameters for the digestion of food targeted towards older adults.

Under *in vitro* semi-dynamic gastric conditions:

- proteolysis of both high protein yoghurt is slower for older adults.
- Proteins of 10 - 30 kDa in the whey based yoghurt are partially resistant to gastric digestion.
- Particle size is nevertheless reduced in the whey based yoghurt.

Point towards the need of a standardised semi-dynamic protocol.

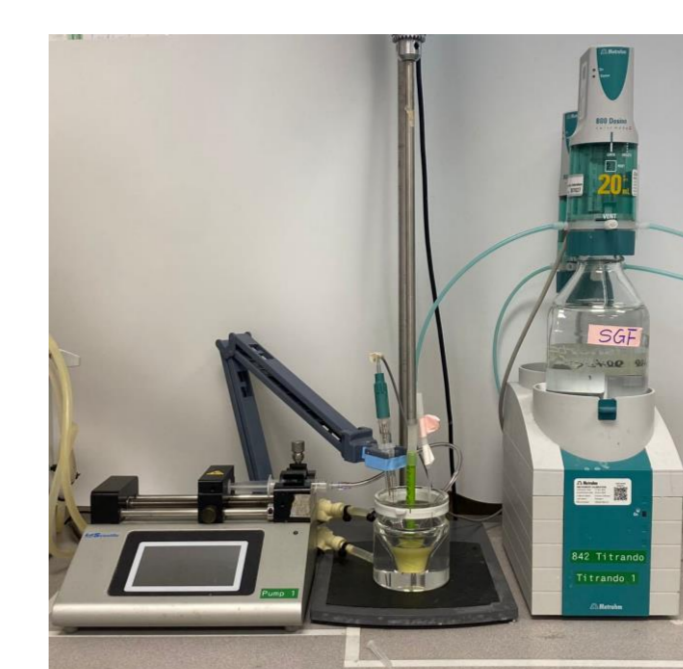
## Methods

### Test food

- Casein based yoghurt (CBY)  
Commercial Skyr & dulce de leche base.
- Whey based yoghurt<sup>4</sup> (WBY)  
In house (INRAE) yoghurt (80:20 whey to casein proteins combined with a WPI enriched caramel like base (Teagasc).

	CBY	WBY
Protein (%)	12.3	8.7
Carbohydrates (%)	11.1	15.4
Fat (%)	1.8	1.7
Calories/g	1.11	1.4

### *In vitro* gastric semi-dynamic digestion



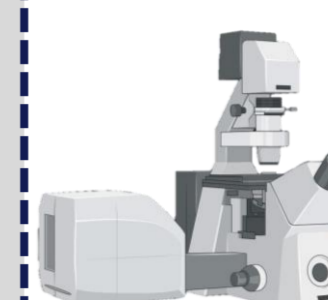
3 gastric emptying (GE) points

- Gastric half-time decreased by a factor of 1.5 for the older adult<sup>5</sup>.
- Pepsin concentration: adult 4000 U/mL older adult 2400 U/ml

### Analysis



Particle size distribution (PSD) at gastric emptying points



Confocal laser microscopy with Fast green and Nile red for staining protein and lipids, respectively.



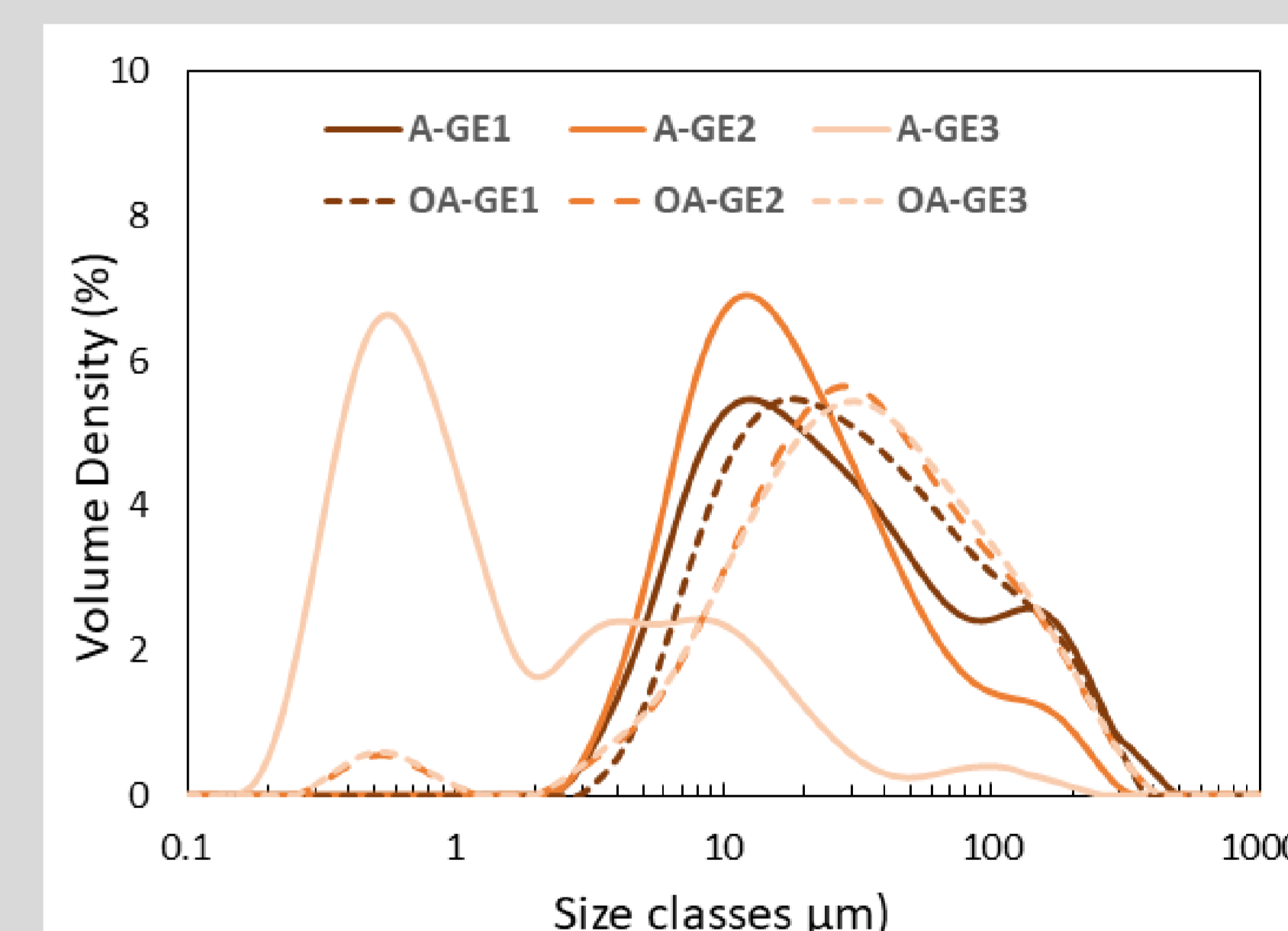
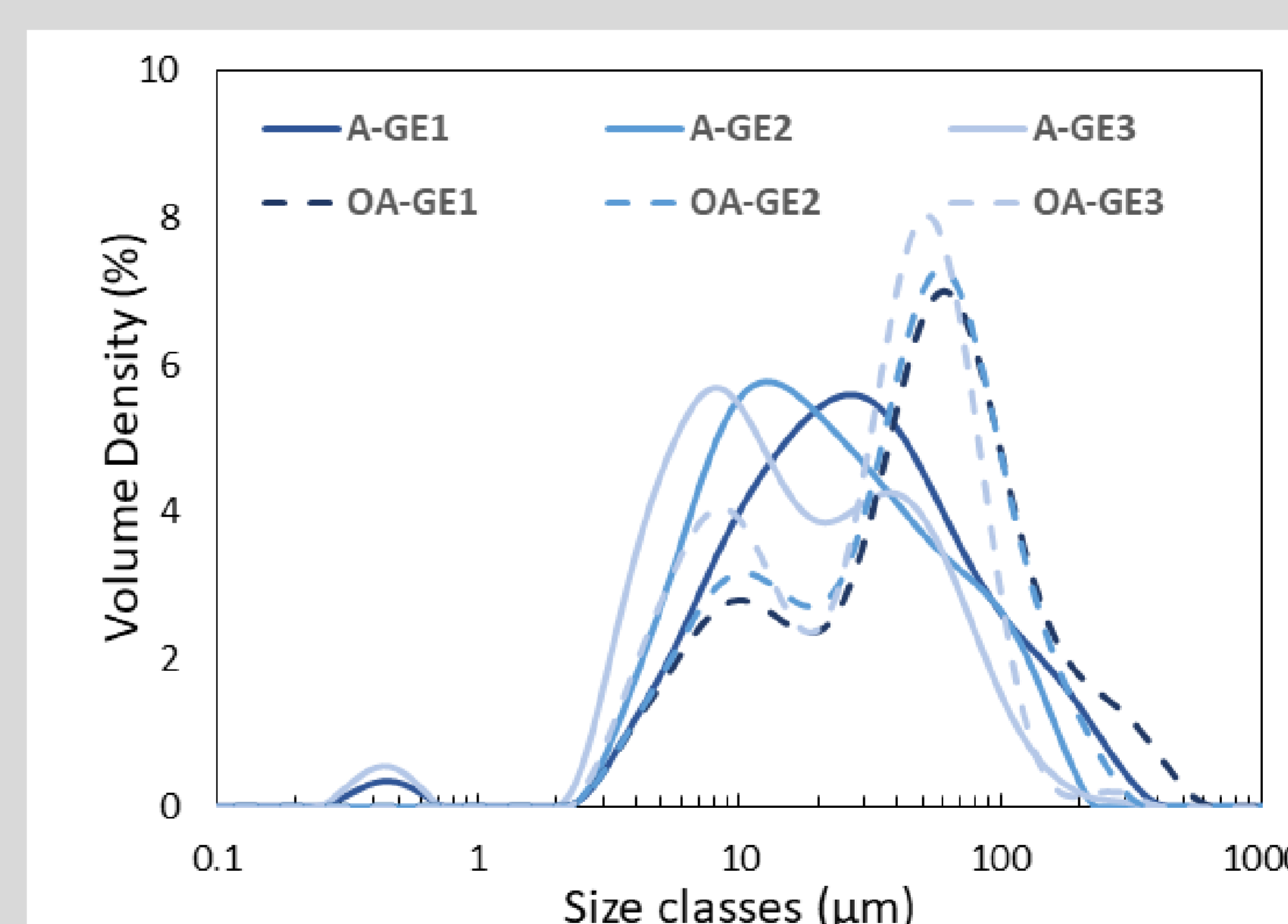
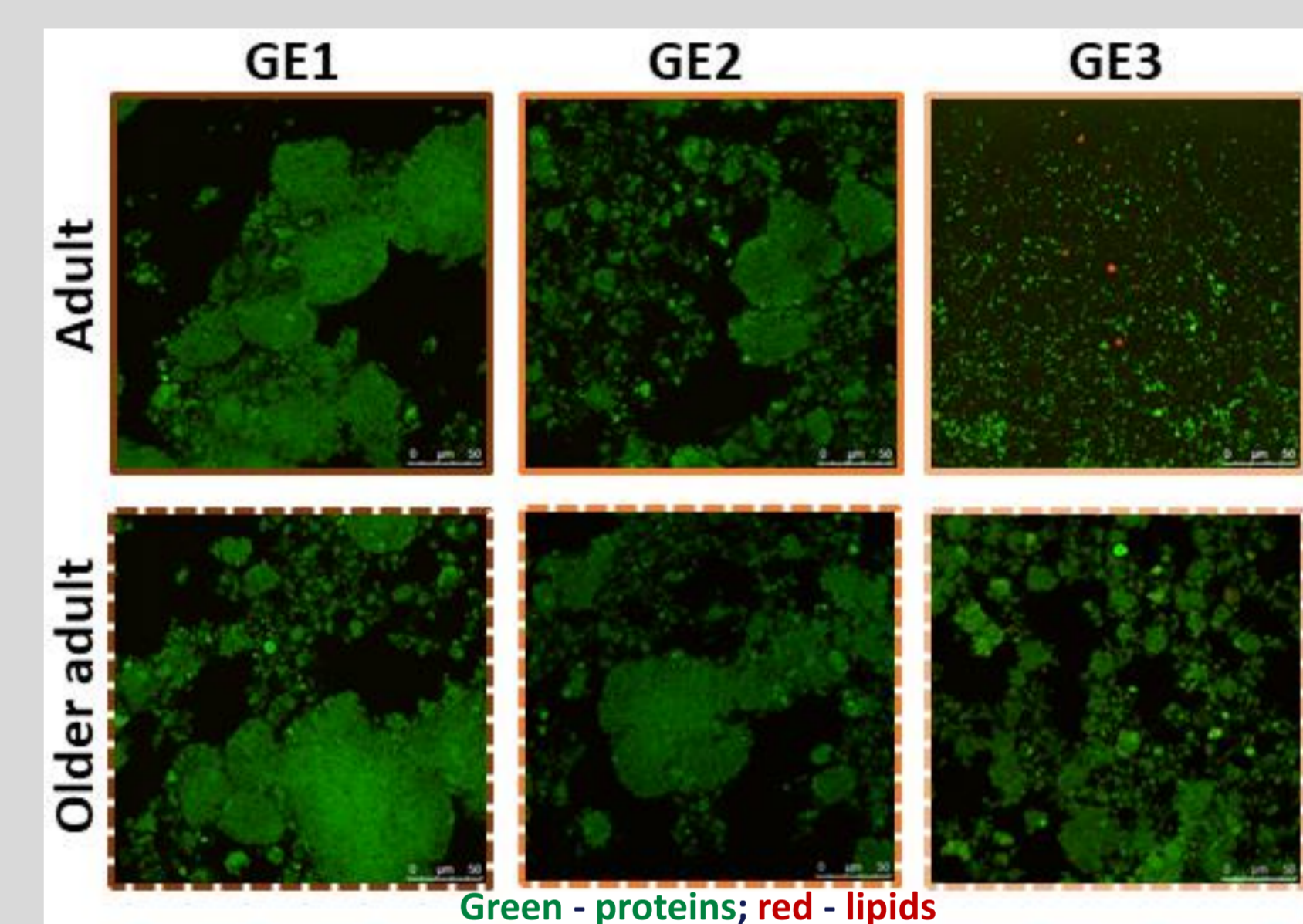
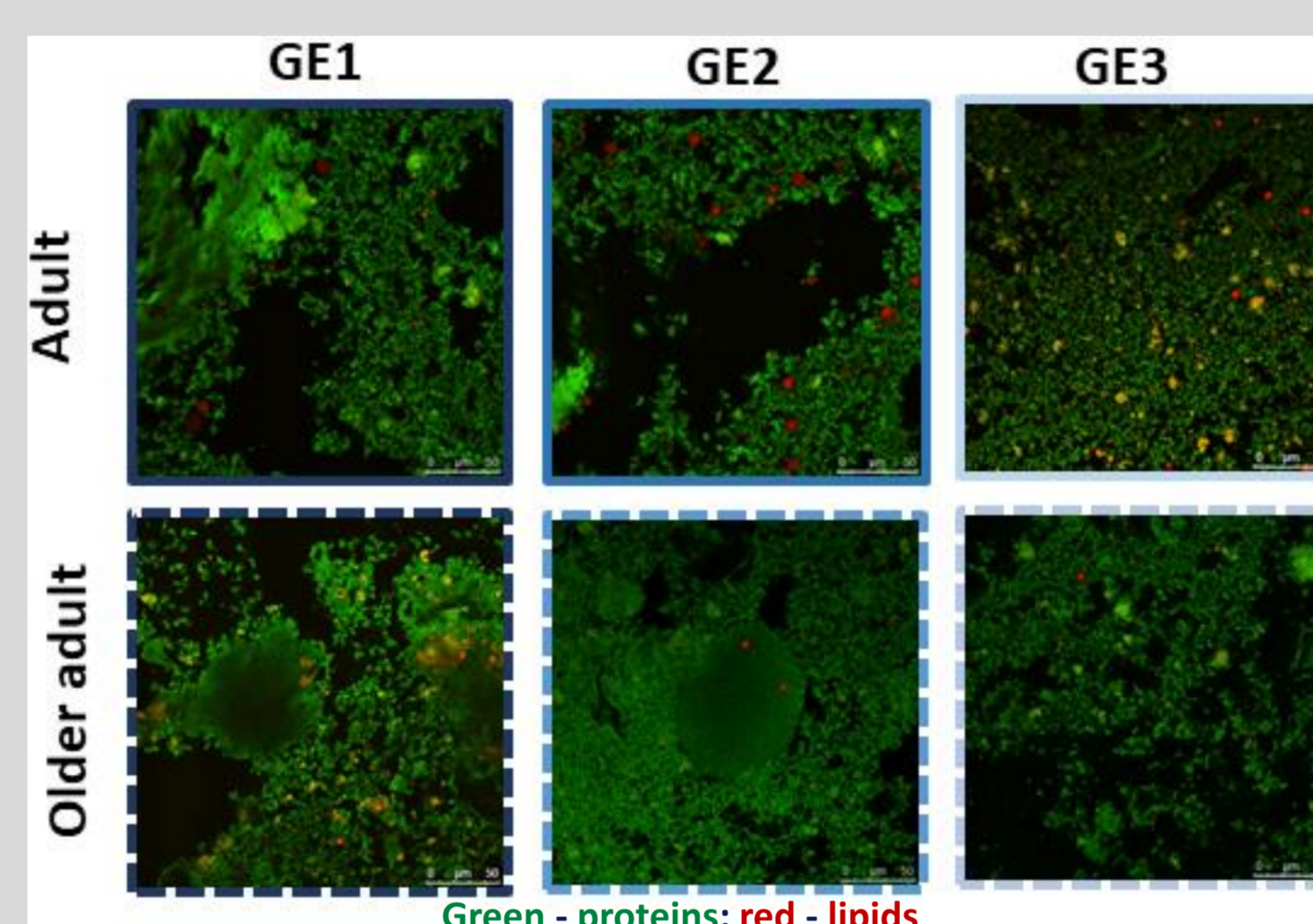
Size exclusion chromatography

## Results & Discussion

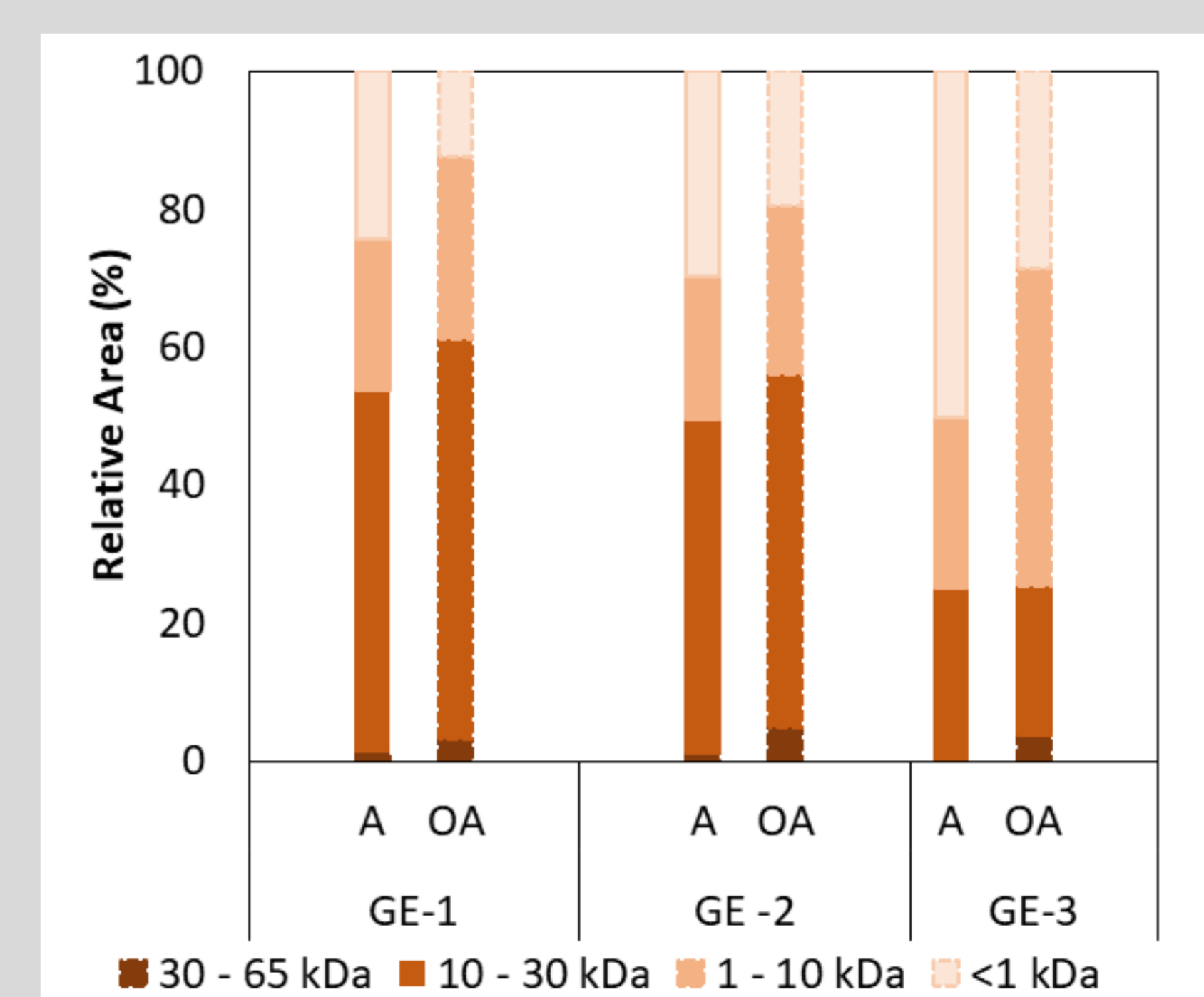
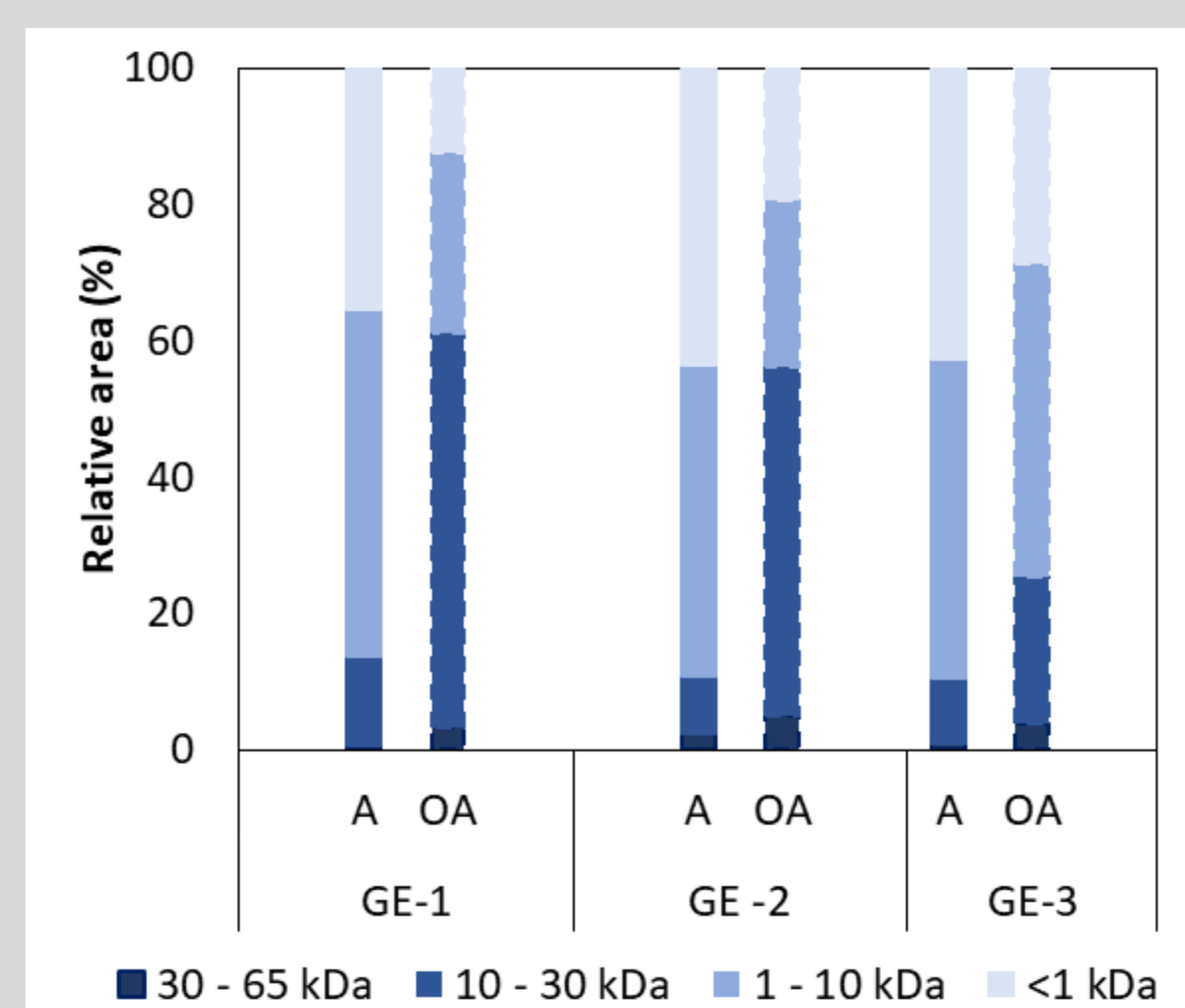
Casein based yoghurt

Whey based yoghurt

CLSM and PSD show a progressive deconstruction of protein aggregates at gastric emptying.



SEC-HPLC reveals distinct pepsinolysis profiles between the adult and older adult models and with respect to the type of yoghurt.



- Proteins of 10 – 30 kDa in the whey based yoghurt are resistant to gastric digestion. Attributed pepsin resistant  $\beta$ -lactoglobulin.
- Larger proteins and peptide fractions are consistently more abundant in the older adult digesta compared to that of the adult.

## Acknowledgement

EAT4AGE project has received funding from the Irish Department of Agriculture and Marine (DAFM) under the umbrella of the European Joint Programming Initiative "A Healthy Diet for a Healthy Life" (JPI HDHL) and of the ERA-NET co-fund ERA-HDHL (GA N° 696295 of the EU Horizon 2020 Research and Innovation Programme).



## References

1. Michel, J. P. et al. (2016). Healthy ageing: Evidence that improvement is possible at every age. *European Geriatric Medicine*, 7(4), 298-305.
2. Loenneke, et al., (2016). Per meal dose and frequency of protein consumption is associated with lean mass and muscle performance. *Clinical nutrition*, 35(6), 1506-1511.
3. Remond et al, 2015;6(16):13858-98. doi: 10.18632/oncotarget.4030.
4. Lavoisier A., 2023 Food Funct., 2023,14, 9377-9390 DOI <https://doi.org/10.1039/D3FO02693K>
5. Ménard, Olivia, et al. "Static *in vitro* digestion model adapted to the general older adult population: an INFOGEST international consensus." *Food & Function* 14.10 (2023): 4569-4582.