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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



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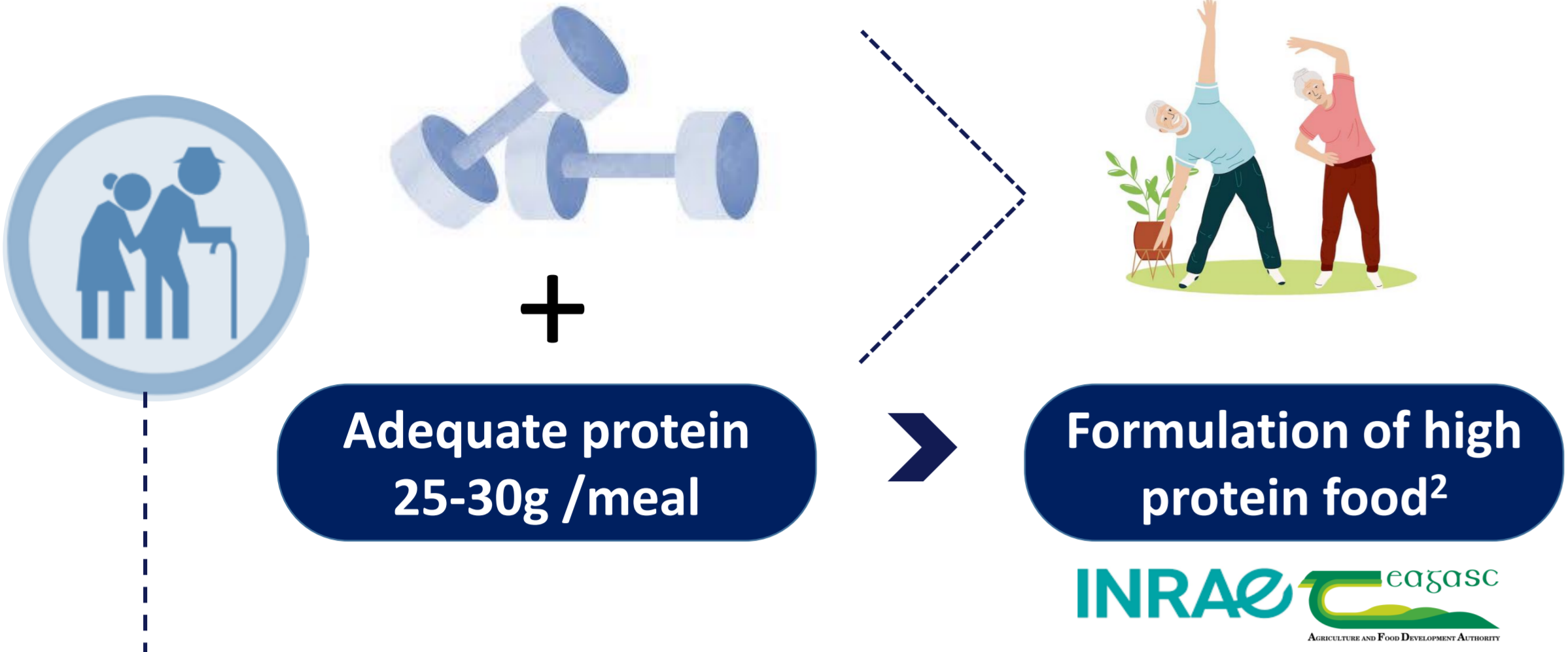


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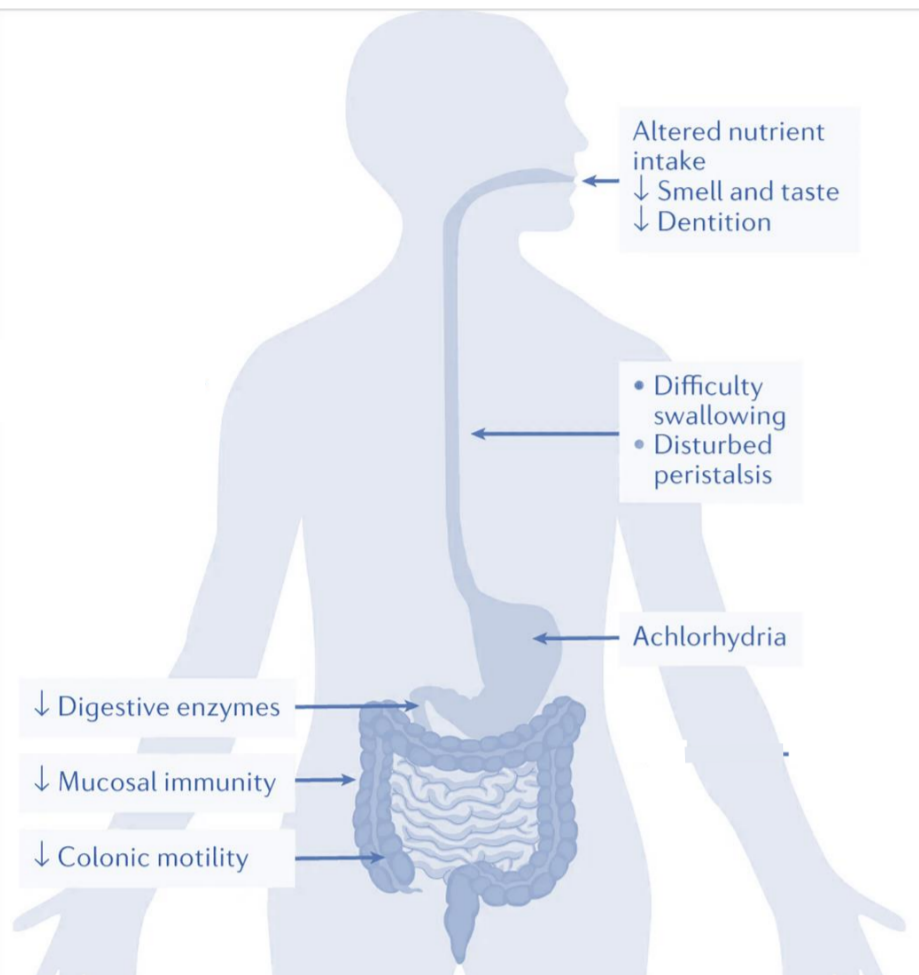


## Introduction

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

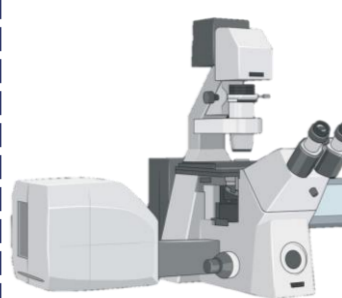
- Gastric half-time decreased by a factor of 1.5 for the older adult<sup>5</sup>.

- 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

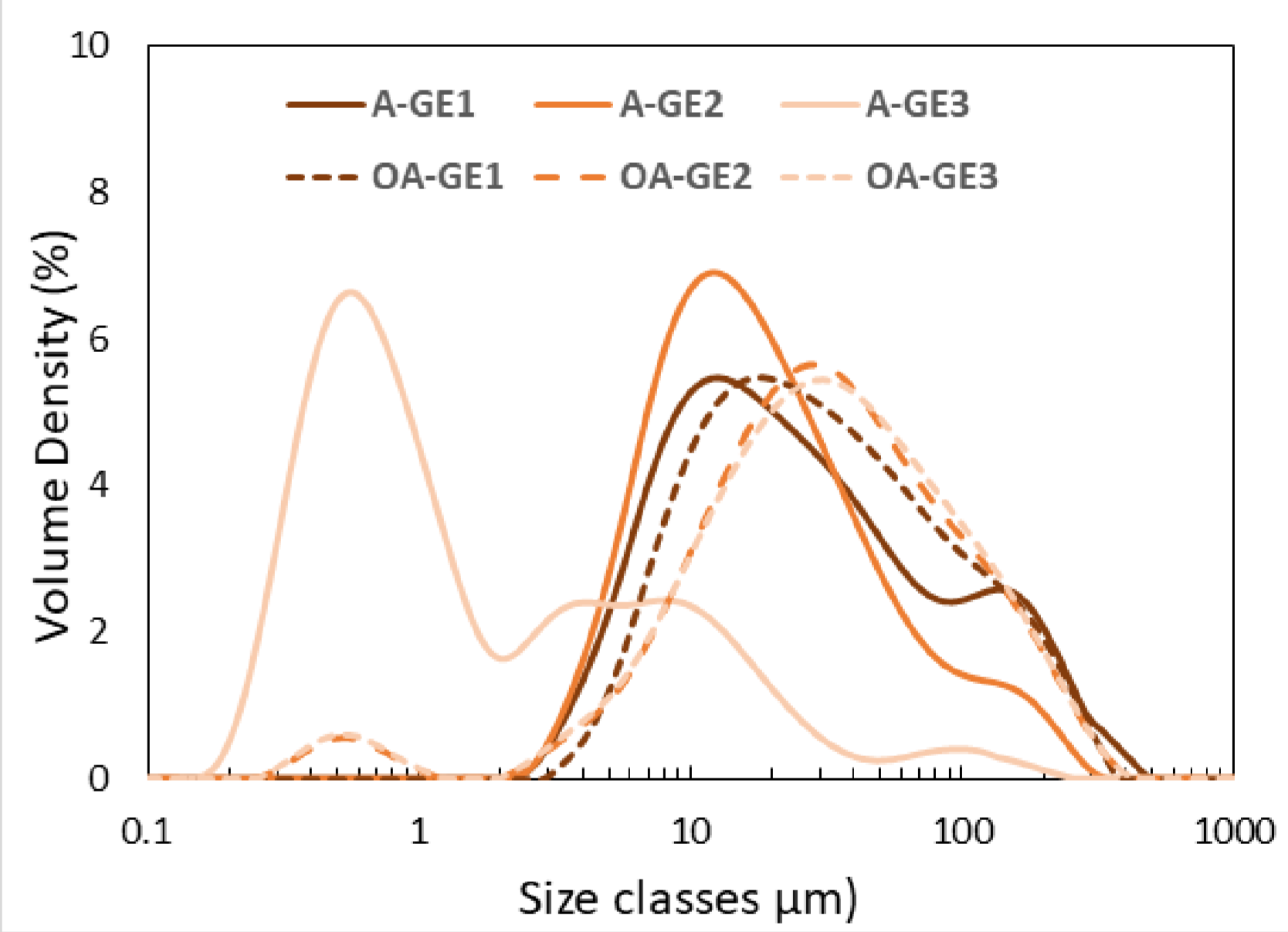
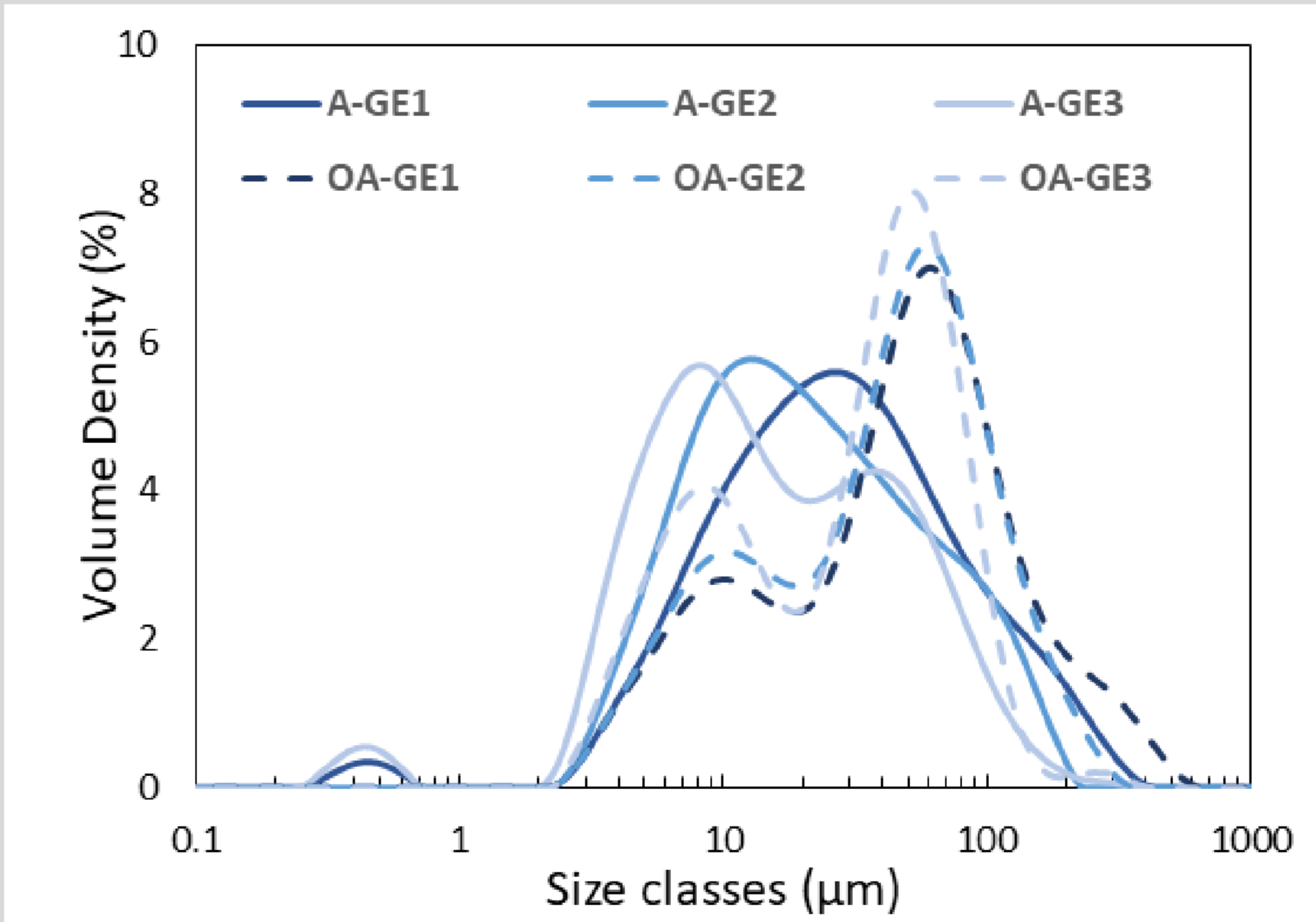
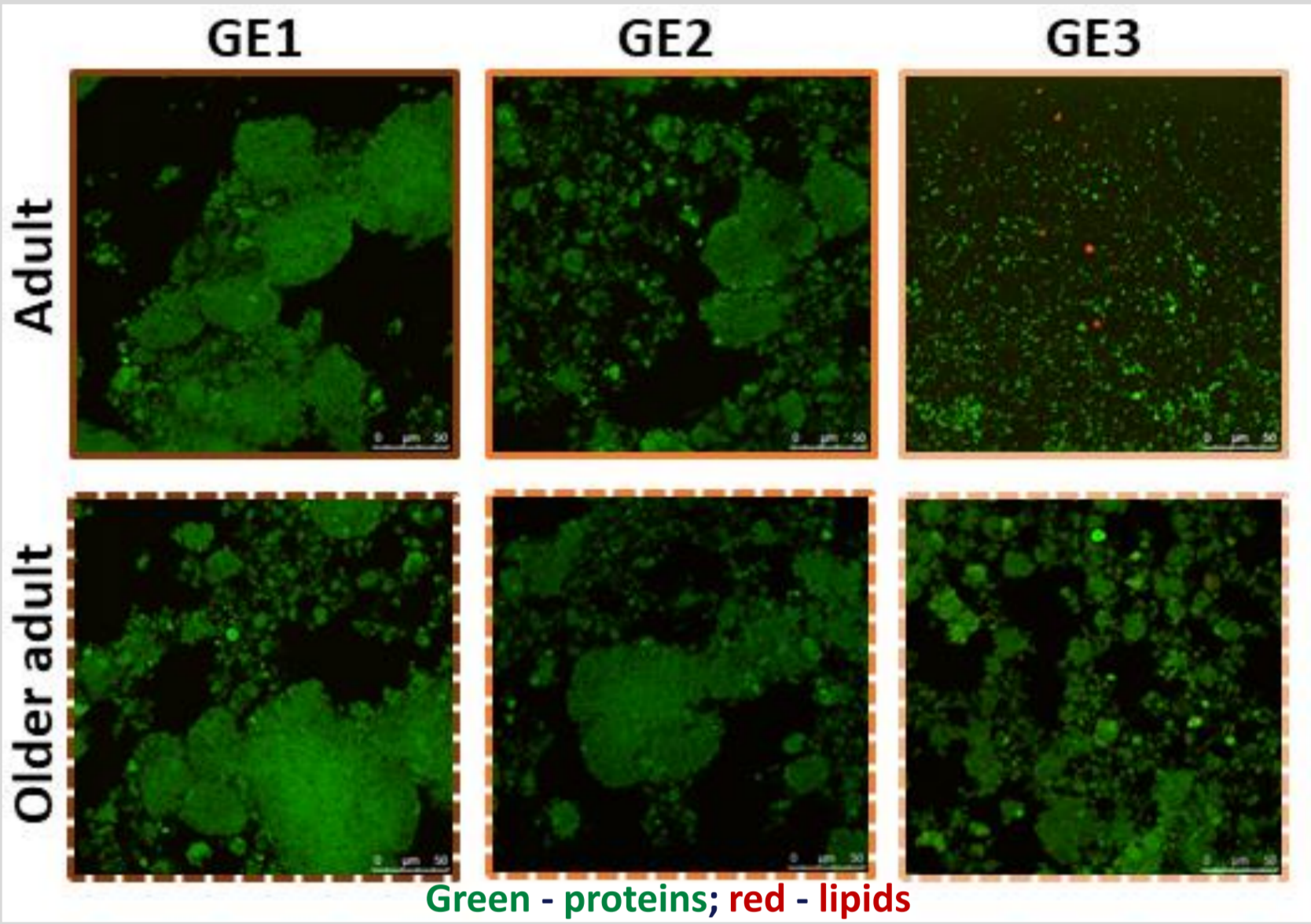
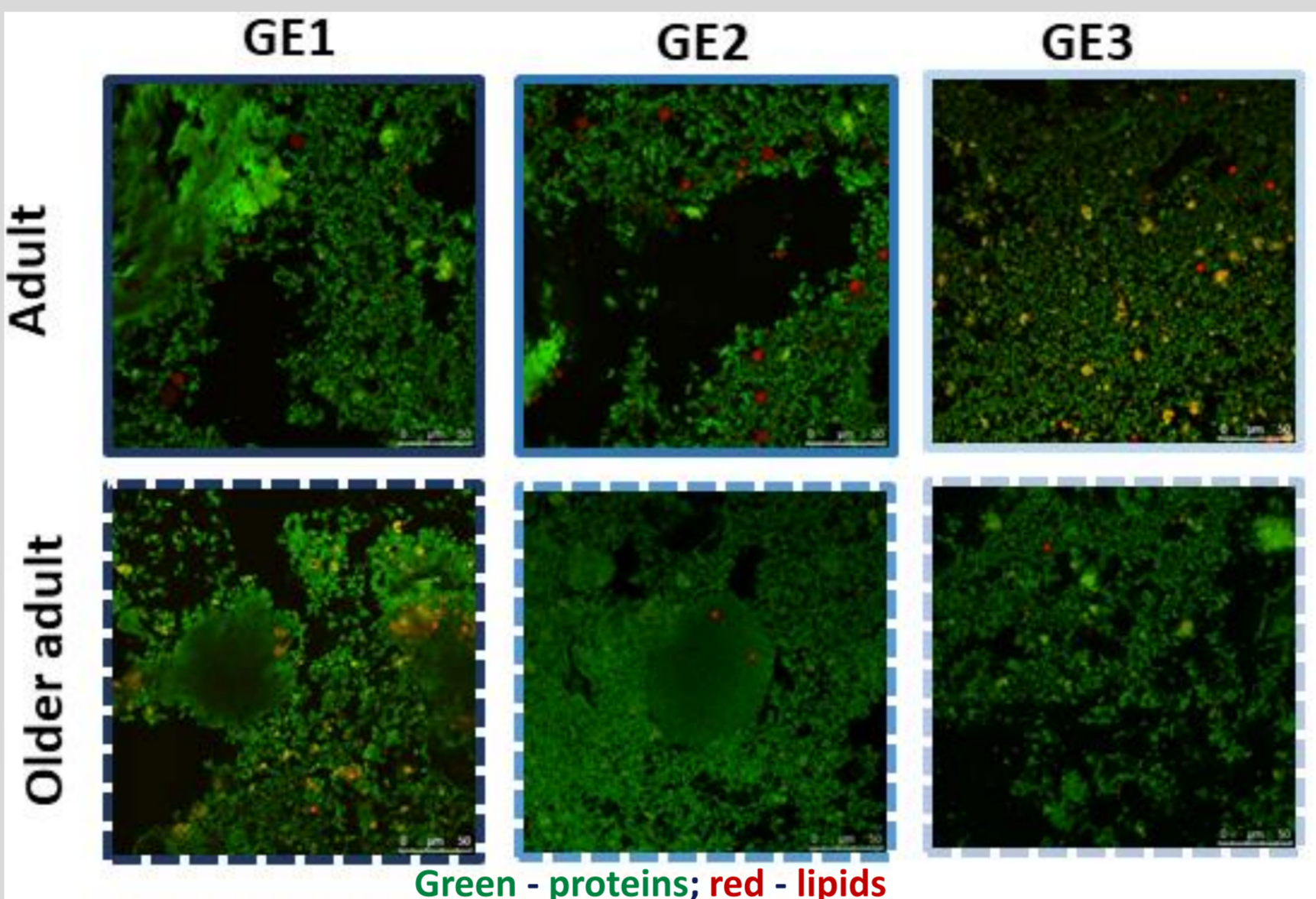


## Results & Discussion

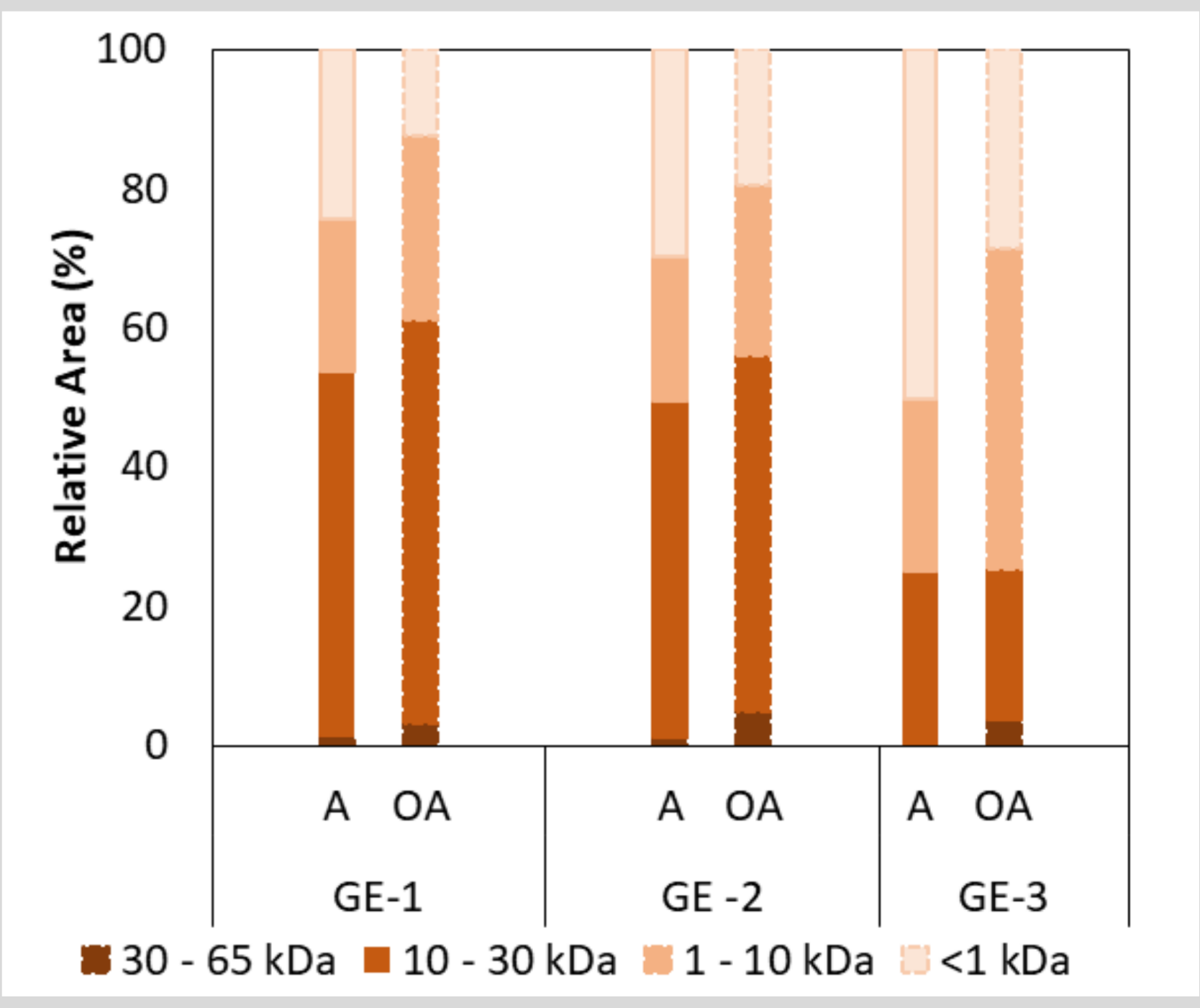
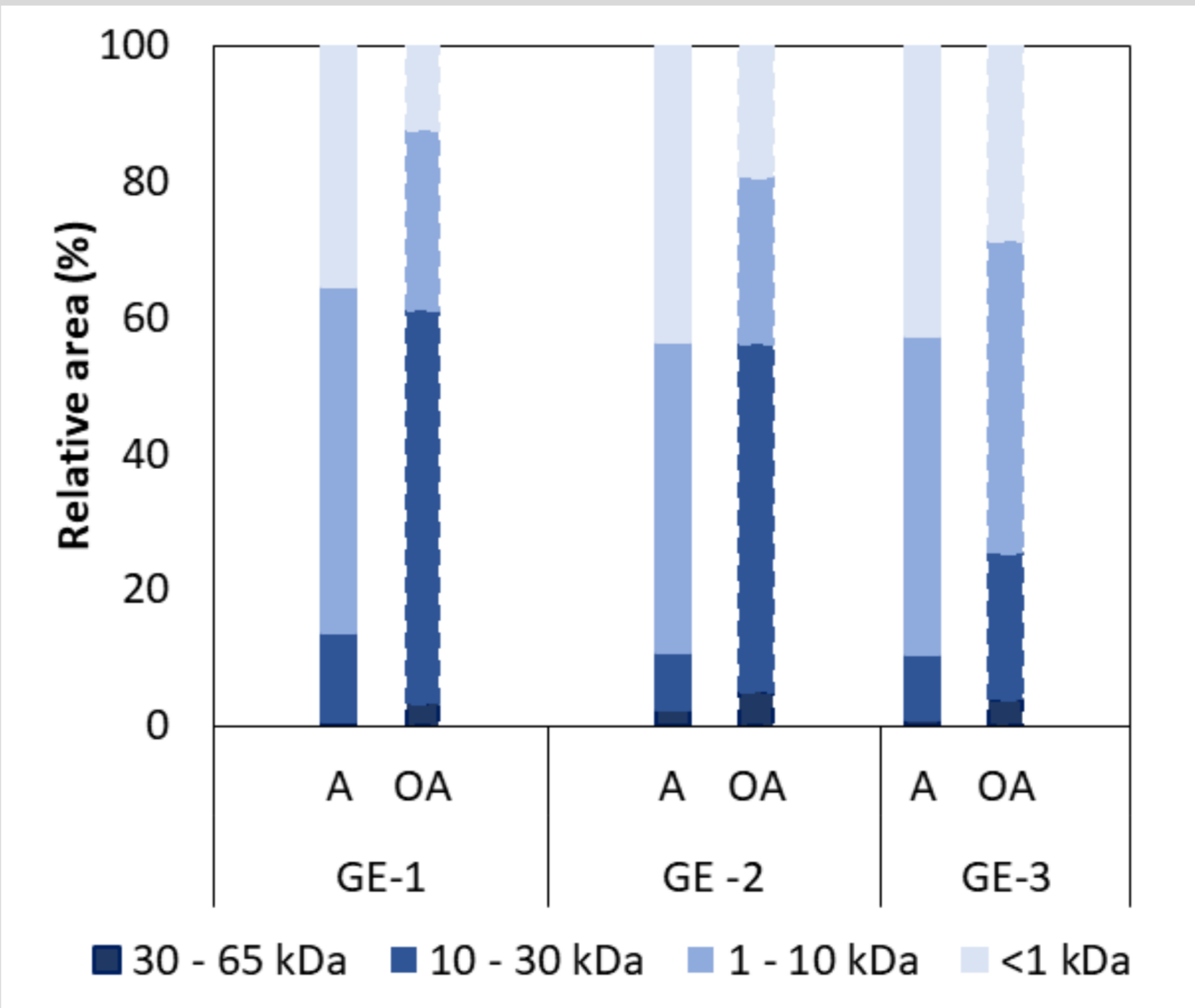
### Casein based yoghurt

### 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.