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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 Gwala¹, Anaïs Lavoisier², Martine Morzel², Didier Dupont², André Brodkorb¹

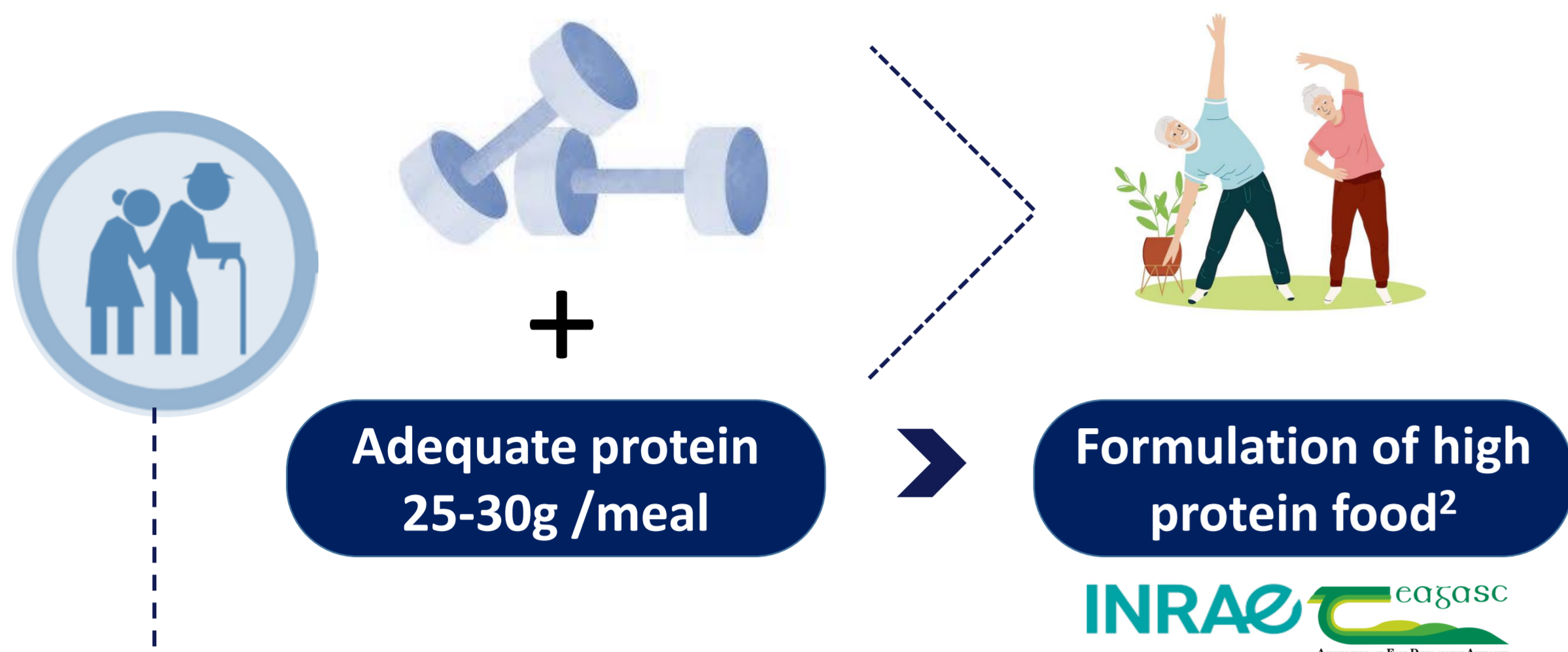
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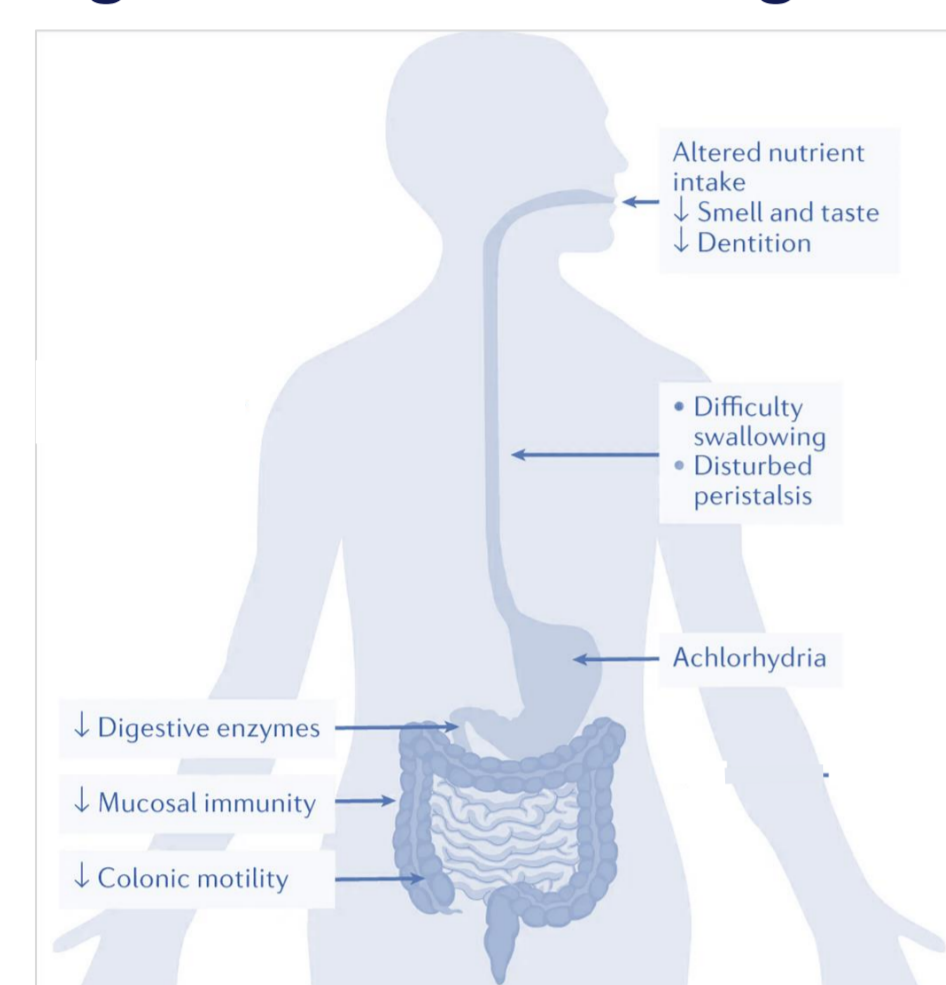
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Introduction

Nutrition & exercise contribute to healthy aging¹.



Age related GIT changes³



- 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.

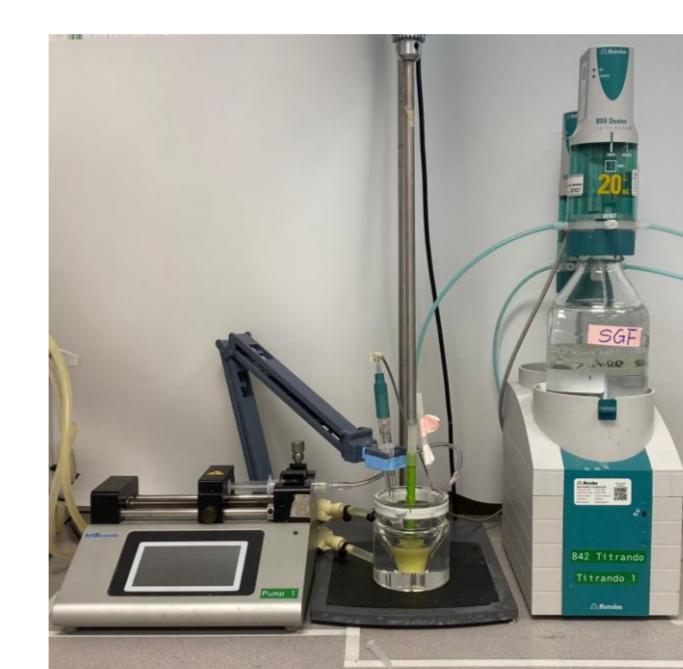
Methods

Test food

- Casein based yoghurt (CBY)
Commercial Skyr & dulce de leche base.
- Whey based yoghurt⁴ (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



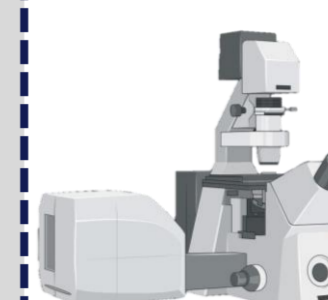
3 gastric emptying (GE) points

- Gastric half-time decreased by a factor of 1.5 for the older adult⁵.
- 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.



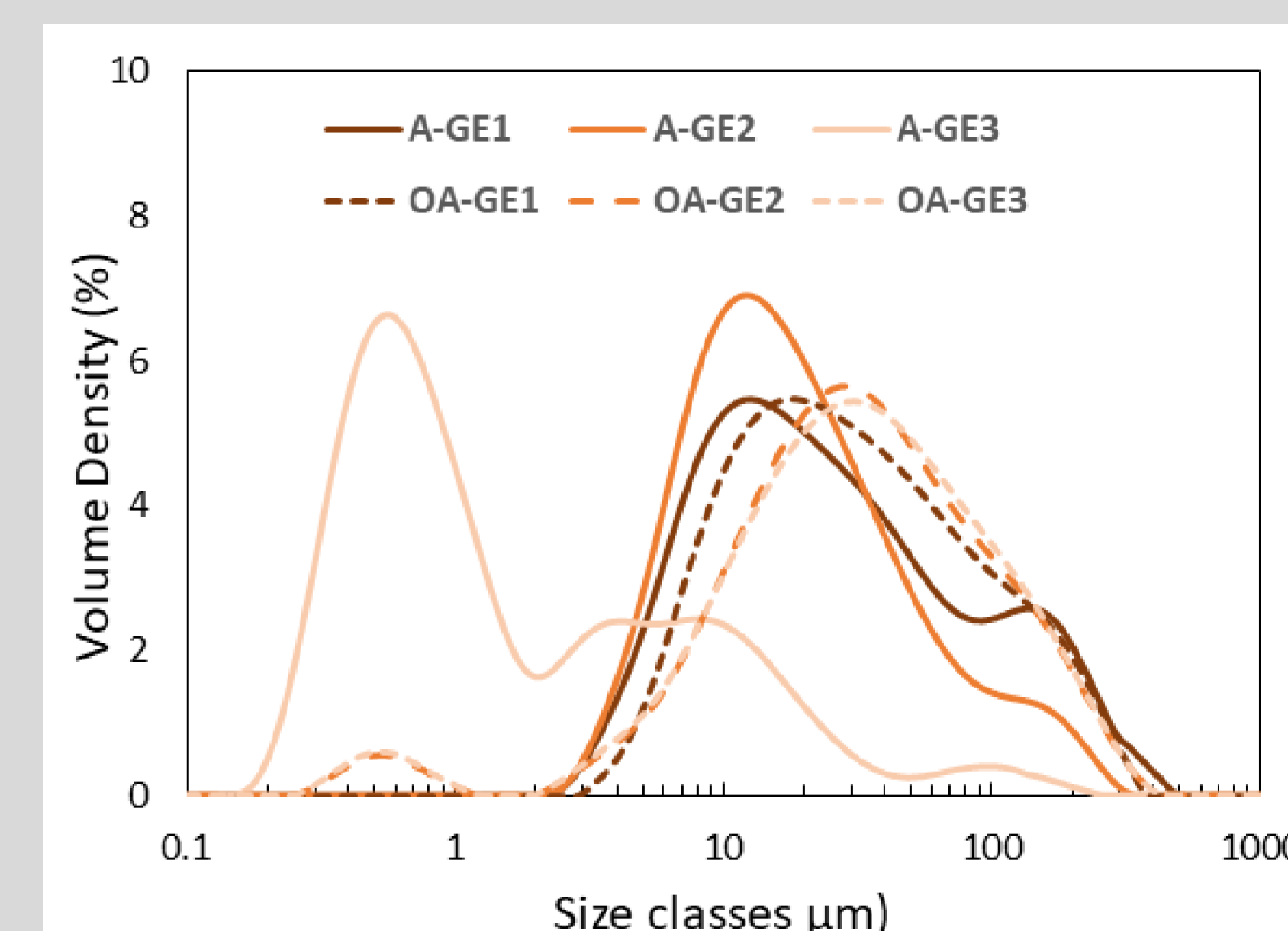
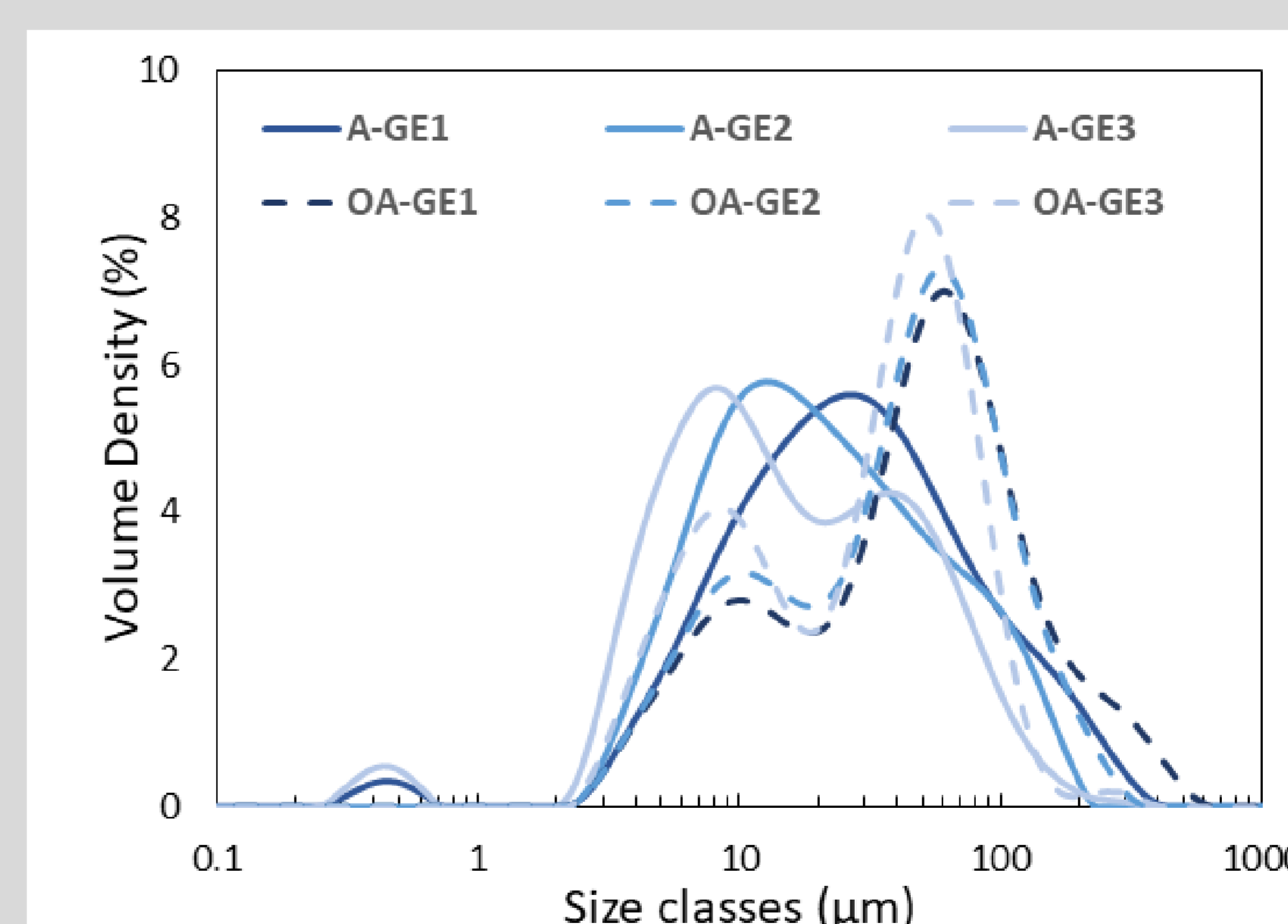
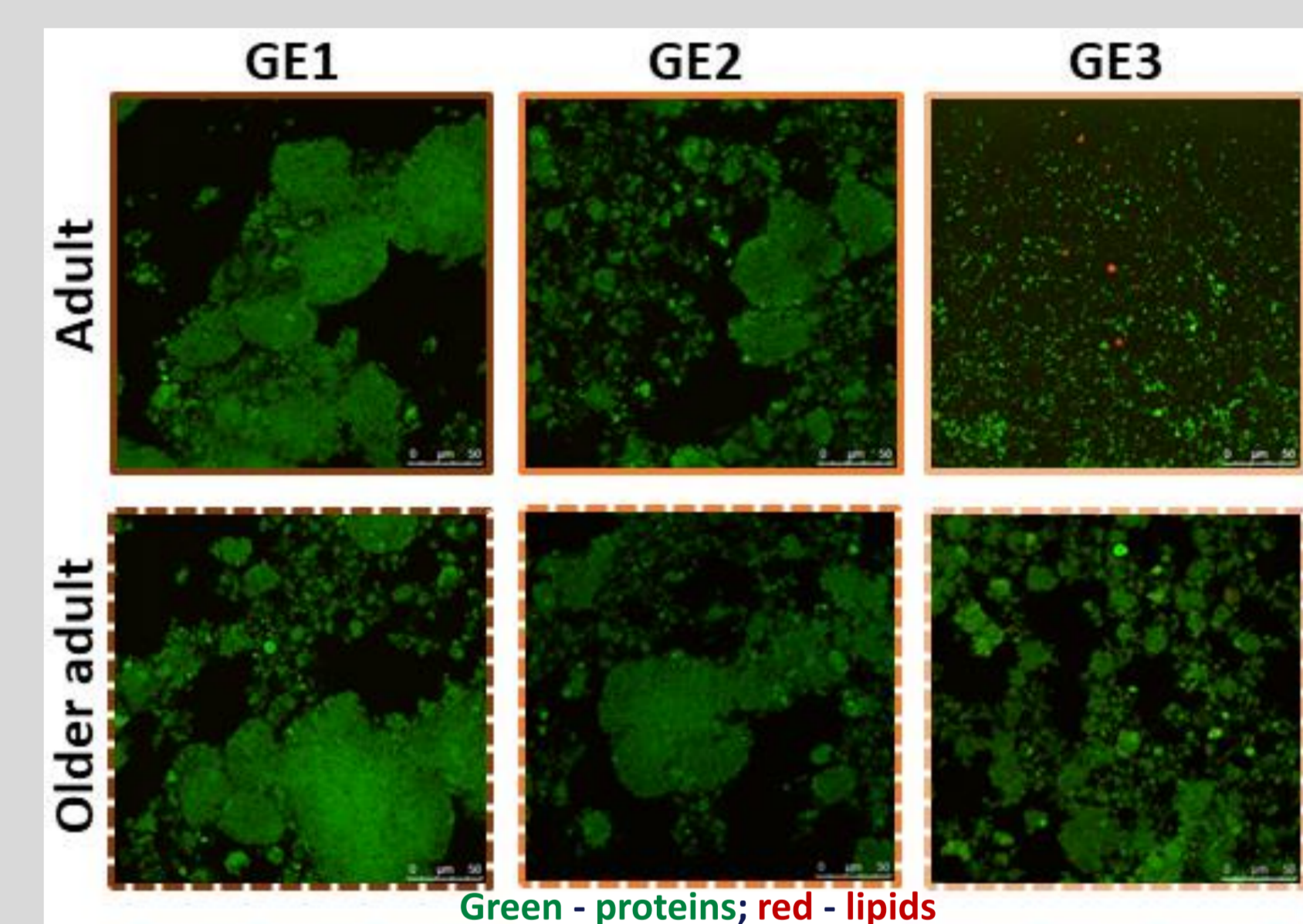
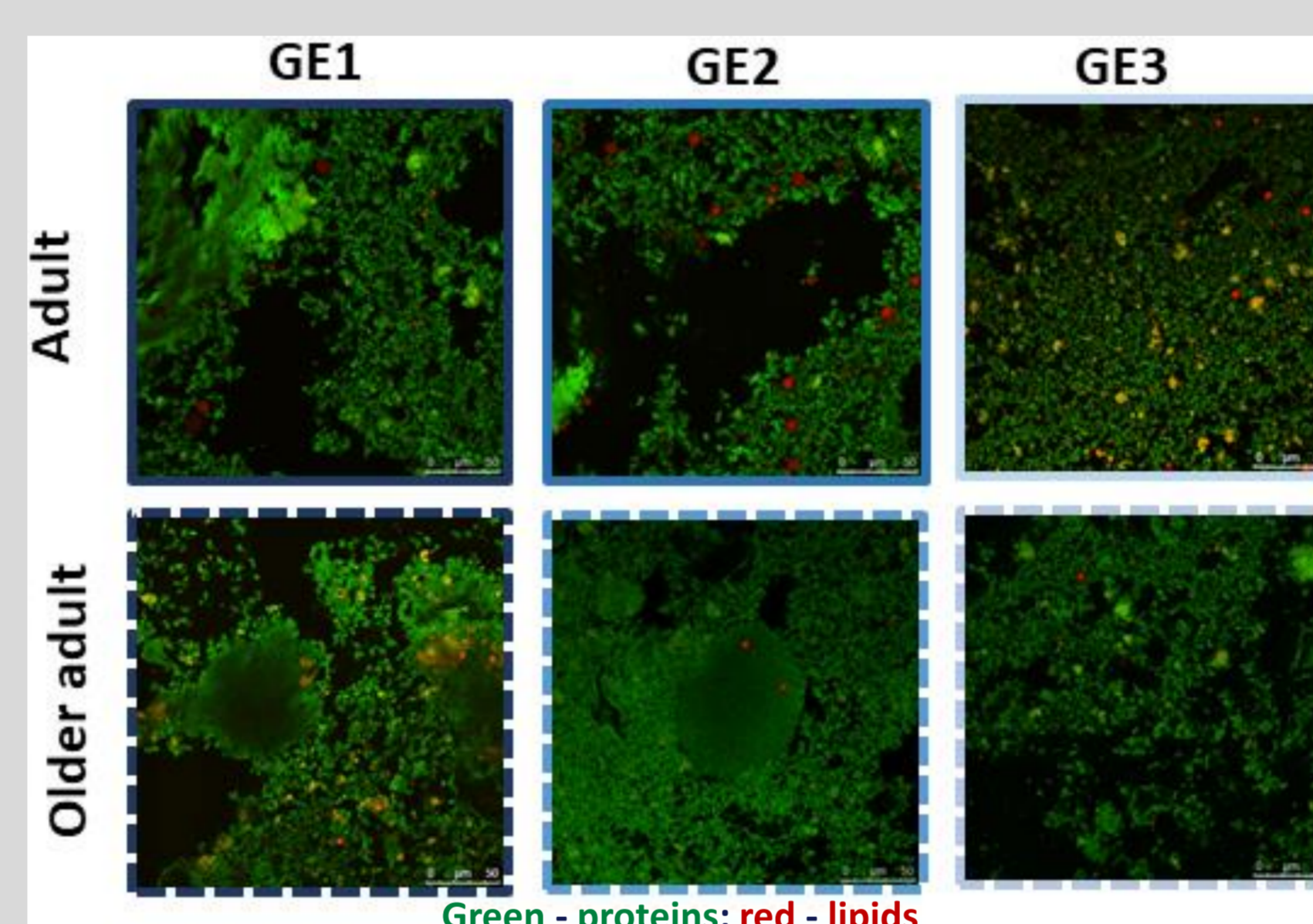
Size exclusion chromatography

Results & Discussion

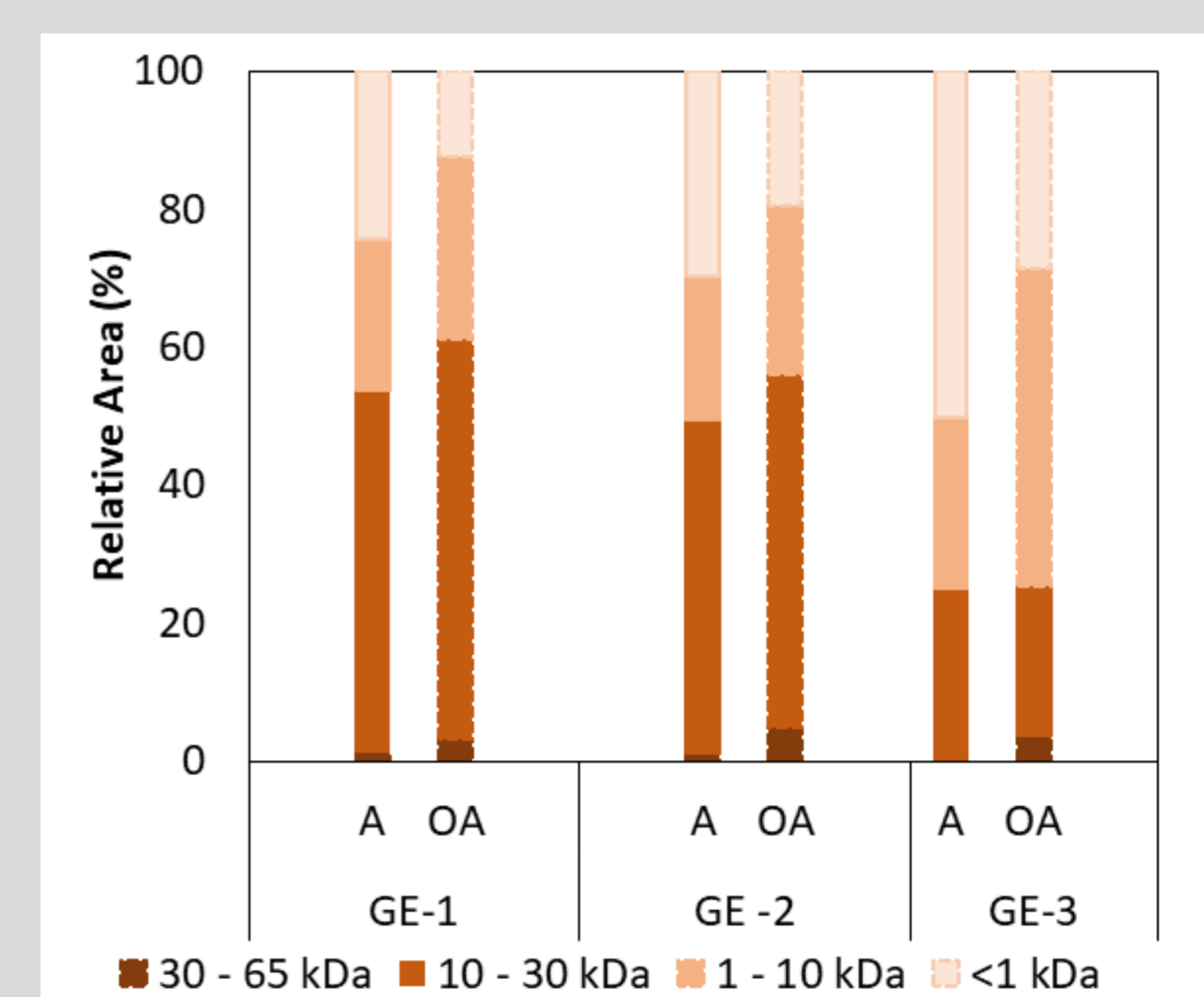
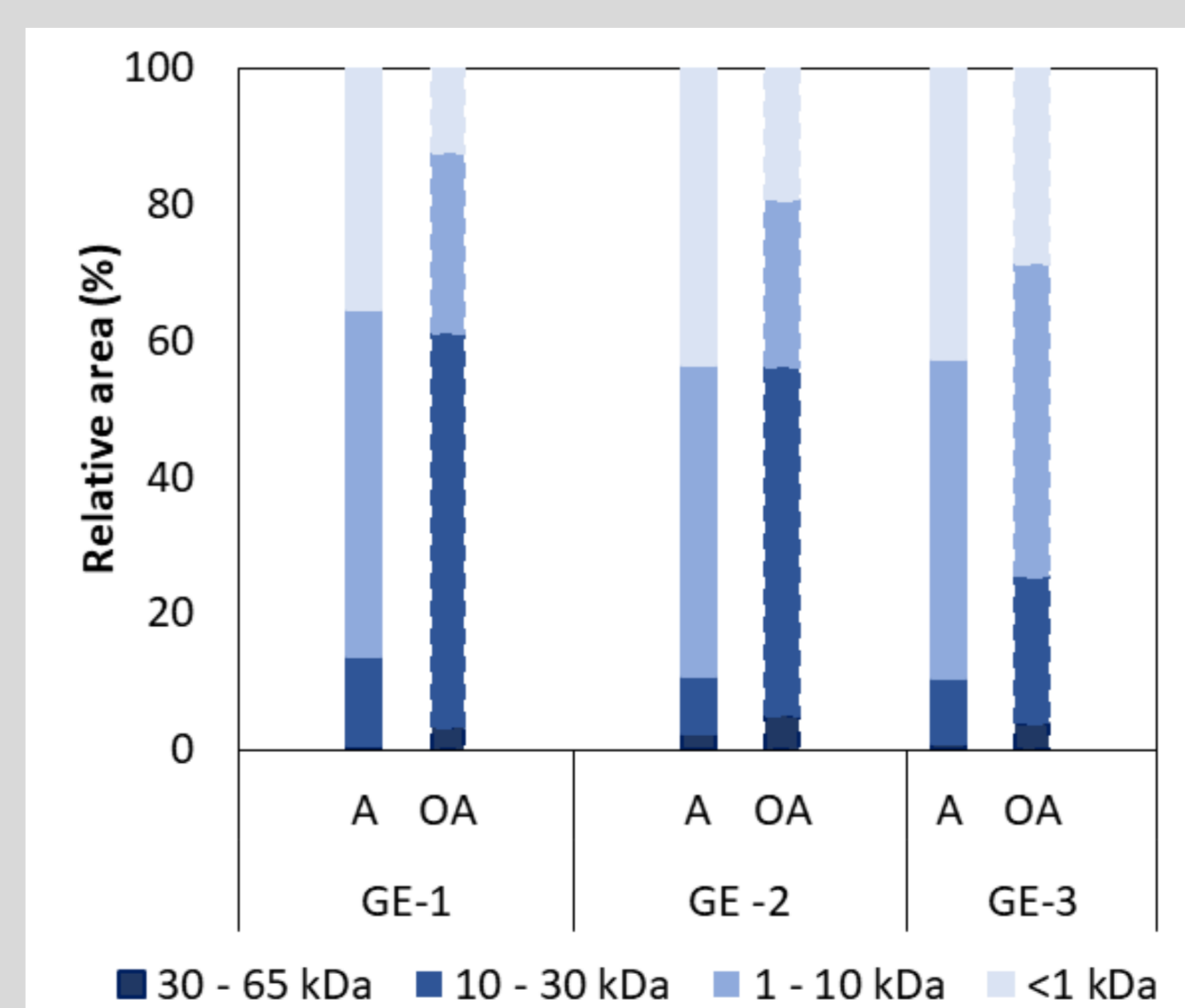
Casein based yoghurt

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 β -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).



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