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In vitro digestion of protein-rich dairy products adapted to the specific needs of older adults

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Introduction



For older adults (> 65 y.) insufficient energy and protein intake can lead to sarcopenia, characterized by the loss of muscle mass, strength, and function.



To avoid this condition, healthy older adults need to consume nutrient-dense foods and increase the amount of high-quality proteins in their diet (at least 1g protein/kg body weight/day).



Milk proteins are interesting to promote muscle health, and particularly whey proteins which are rich in leucine.



Ageing leads to changes in the functionality of the digestive tract but the impact of ageing on the intake, digestion, and absorption of nutrients is still unclear.

Objective

Investigate the impact of age on the digestion (proteolysis & lipolysis) of high-protein cream cheese samples in different static *in vitro* conditions.

Materials & Methods

High-protein cream cheese

- 24% w/w of proteins, and 20% w/w of lipids
- **WP-20** = formulated with a ratio of whey proteins (WP) to caseins (CAS) of 20 to 80% (= milk)
- **WP-80** = formulated with a ratio WP:CAS of 80:20

Static *in vitro* digestion



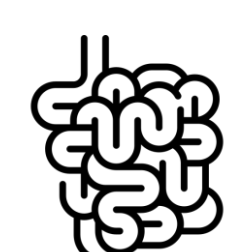
Oral phase

1: 1 food: SSF dilution according to dry matter
pH = 7.0, no chewing, no amylase



Gastric phase

	Young adults	Older adults
pH:	3.0	3.7
Duration:	2 h	3 h
Pepsin:	2000 U ml ⁻¹	1200 U ml ⁻¹
Gastric lipase:	60 U ml ⁻¹	36 U ml ⁻¹



Intestinal phase

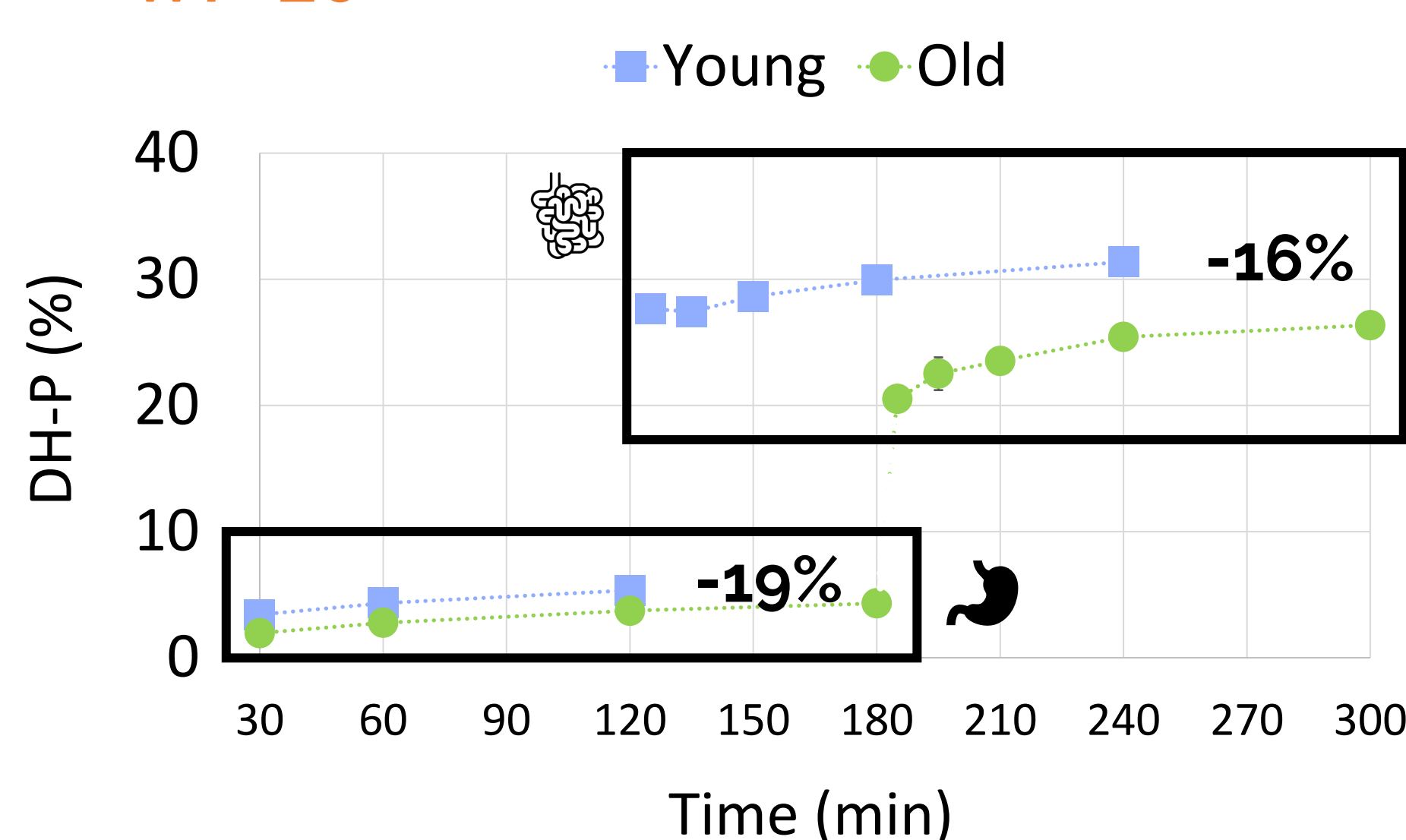
	Young adults	Older adults
[Ca ²⁺]:	0.6 mM	1 mM
pH:	7.0	7.0
Duration:	2 h	2 h
Pancreatin:	100 U ml ⁻¹	80 U ml ⁻¹
Bile salts:	10 mM	6.7 mM

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Results

Degree of protein hydrolysis (DH-P)

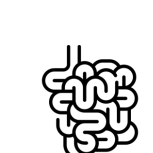
WP-20



In older adults conditions, protein hydrolysis was decreased in the gastric and intestinal phases, probably because of:

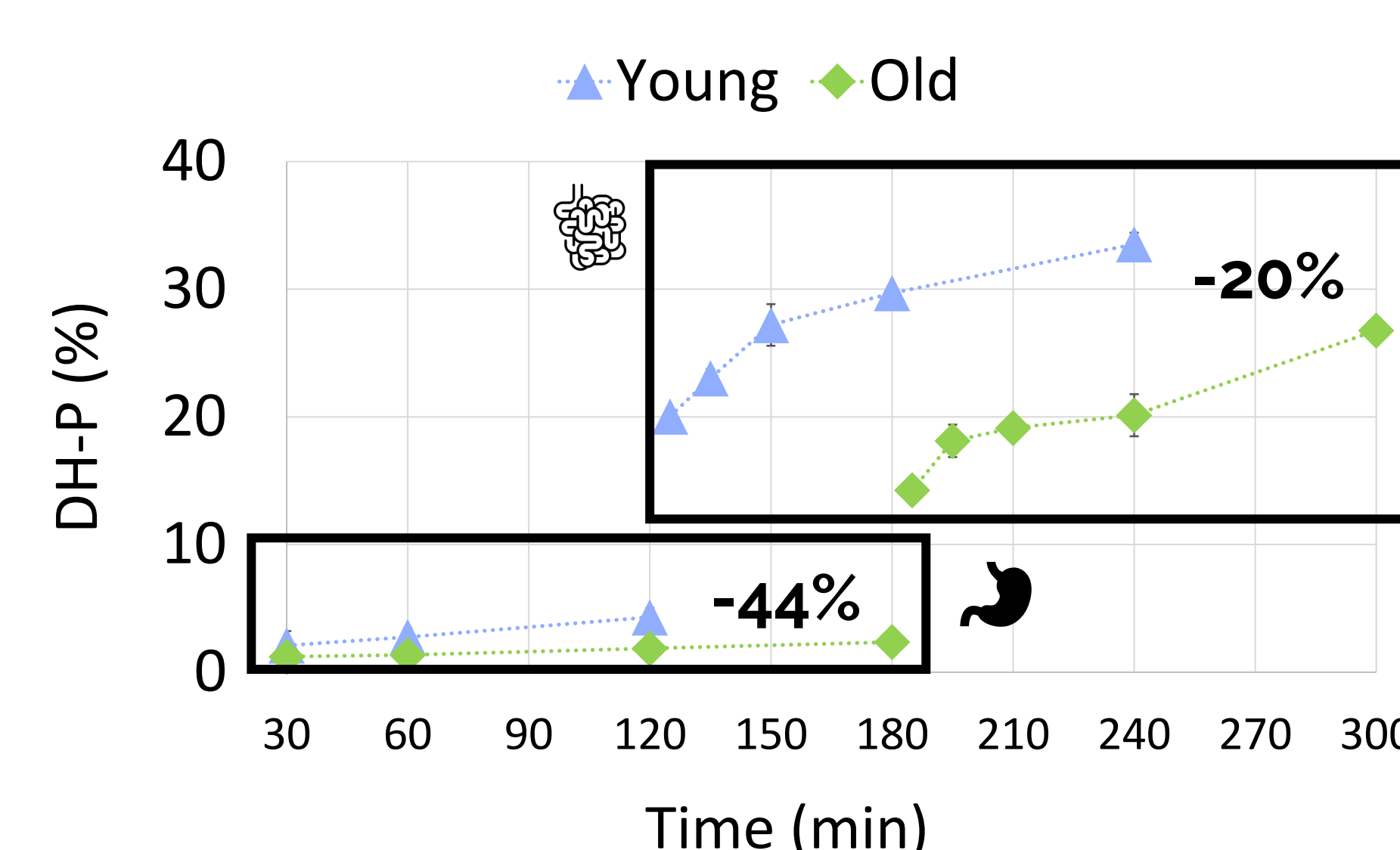


lower pepsin concentration and higher pH



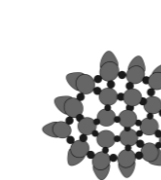
lower concentration in pancreatin and bile salts

WP-80

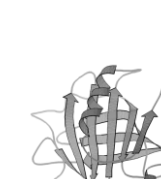


In the gastric phase, the impact of age was stronger in WP-80 than in WP-20.

SDS-PAGE results showed that:



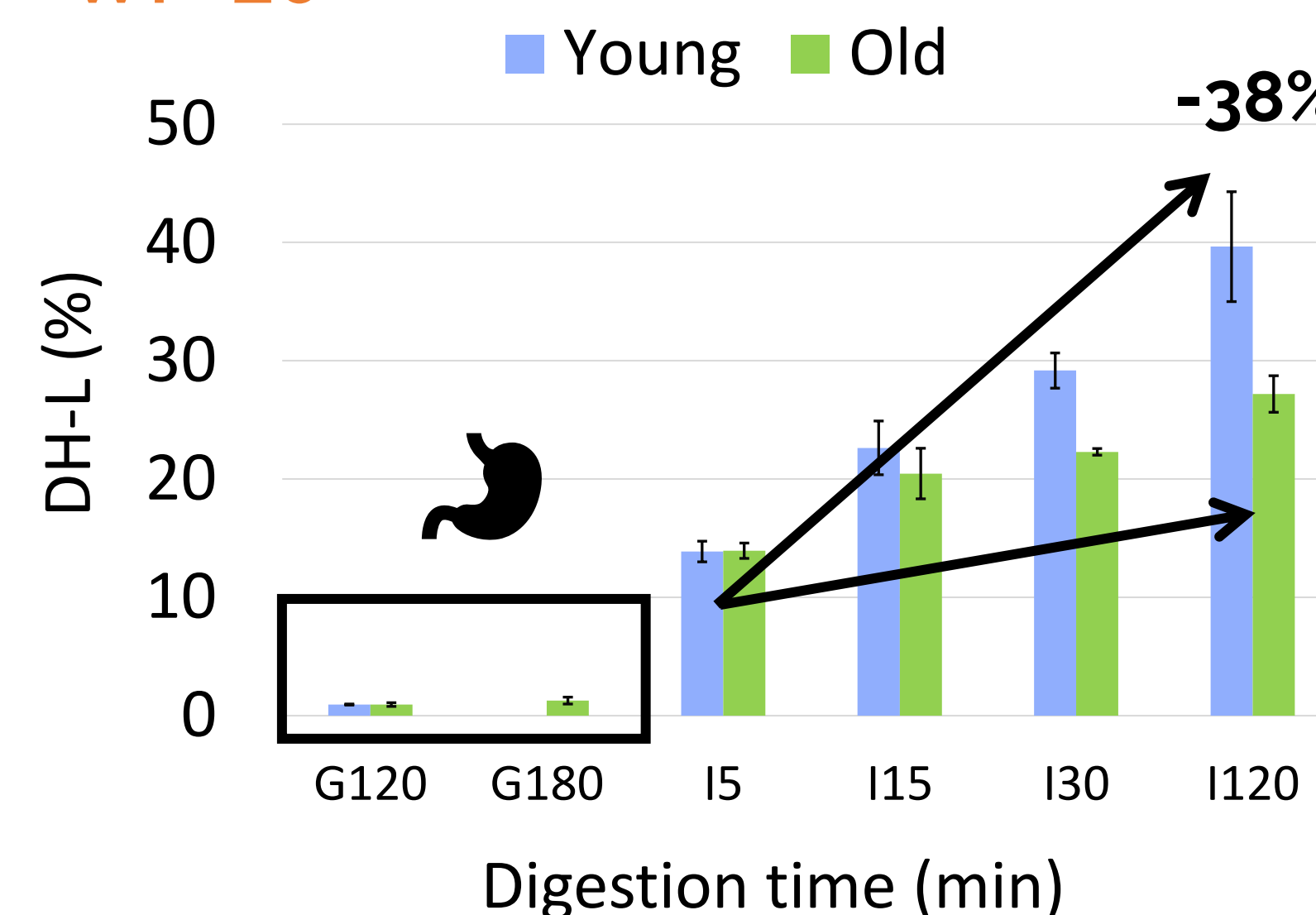
caseins were digested more rapidly than WP in the gastric phase



beta-lactoglobulin was particularly resistant to pepsin hydrolysis.

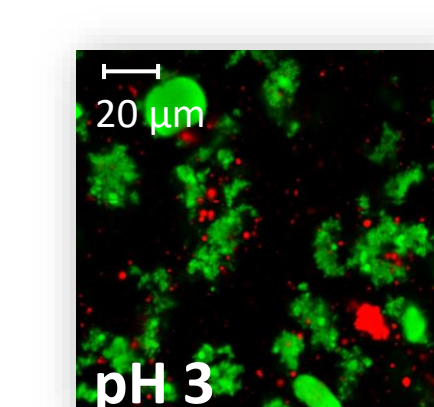
Degree of lipid hydrolysis (DH-L)

WP-20



In WP-20, lipid digestion started in the intestinal phase for young and older adults.

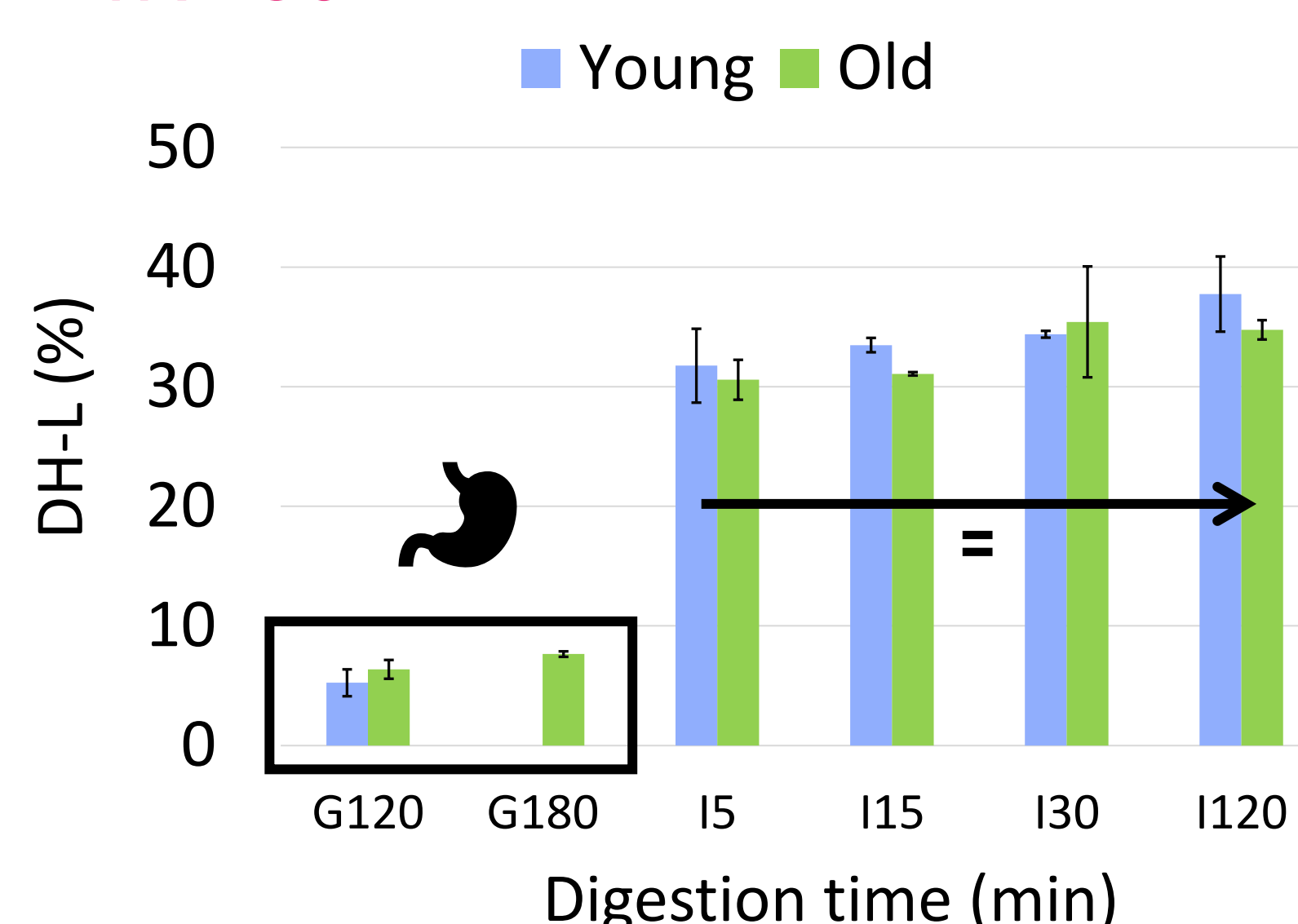
Then different kinetics of lipid hydrolysis were observed according to the age condition.



Partial coalescence

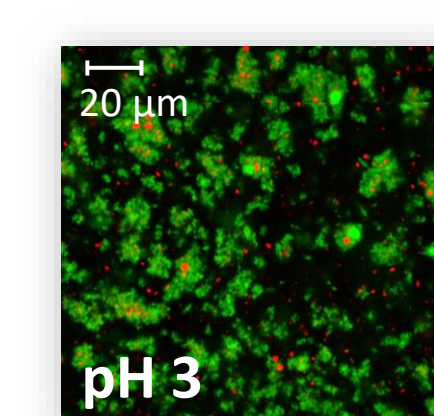
Caseins aggregation

WP-80



Lipid hydrolysis in WP-80 was not influenced by age.

It started in the gastric phase and progressed rapidly during the first minutes of the intestinal phase.



Smaller lipid droplets

Limited protein aggregation

Conclusions

- Age had a significant impact on the digestion of high-protein cream cheese samples, however this effect depended on the ratio of caseins to WP in the product,
- At the end of the digestion, the hydrolysis of proteins was reduced in both samples in digestive conditions relevant to the physiology of older adults, but lipid hydrolysis was higher in the WP-rich sample (WP-80) than in the casein-rich sample (WP-20).
- Essential to carefully consider the composition, the structure, and the digestibility of dairy products to meet the specific needs of the older adult population.

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