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Oil bodies extraction from grains

Myriam Grundy¹ | Vincenzo di Bari² | David Gray² | Peter Wilde³

Introduction

Oat and amaranth consumption have been associated with various positive health effects, in particular the reduction of cardiovascular disease risks such as blood cholesterol levels. However, the two grains differ in terms of taxonomy (*Avena* vs *Amaranthus*, mono- vs dicotyledon), morphology and nutritional composition. On the other hand, both grains contain higher amount of lipids and lipid soluble compounds compared to other cereals and pseudo-cereals. The structure and composition of their lipid storage organelles, oil bodies (OBs), are likely to play a role in their impact on health.

Aim and method

The aim of this work was to extract OBs from oat and amaranth grains and investigate their composition, physicochemical properties and digestibility. To address this objective the following method was used:

- OBs were isolated from oat and amaranth using wet- and cryo-milling
- Composition and overall structure of the extracted OBs were obtained using light microscopy, laser diffraction and ATR-FTIR
- OBs were digested using the pH-stat.

Results

OBs extraction

- The recovery of OBs was higher for amaranth compared with oat, and this regardless of the method employed (Figure 1).
- Once hydrated, isolation of OBs from oat was challenging because of the β -glucan it contains and the viscosity it generates.

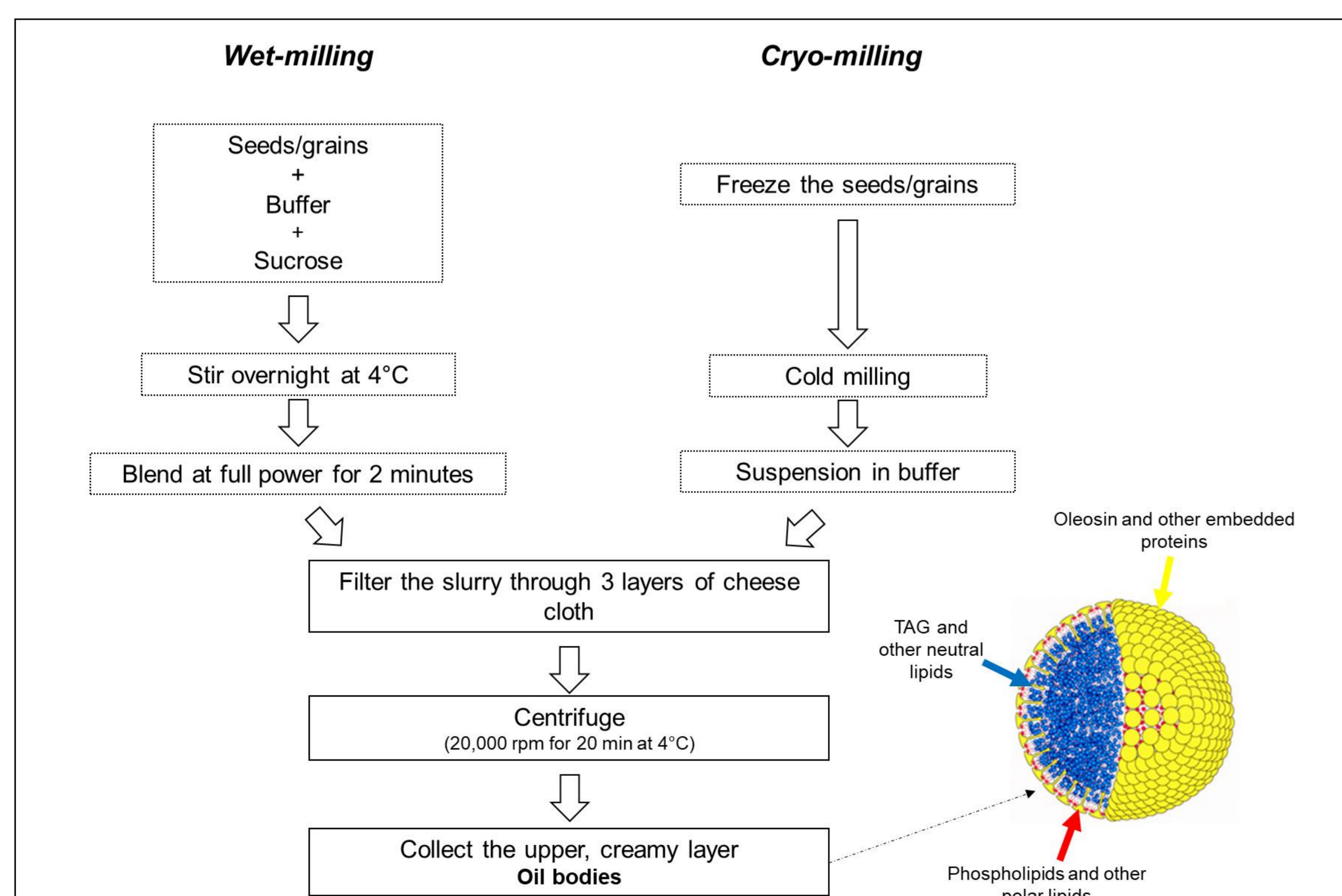


Figure 1: Extraction methods used. The schematic representation of the oil body is adapted from (Huang 1994).

OBs characterisation

The particle size distribution confirmed the microscopy images that there was a great disparity in the size of OBs: oat (4.5 μm) > amaranth (0.4 μm).

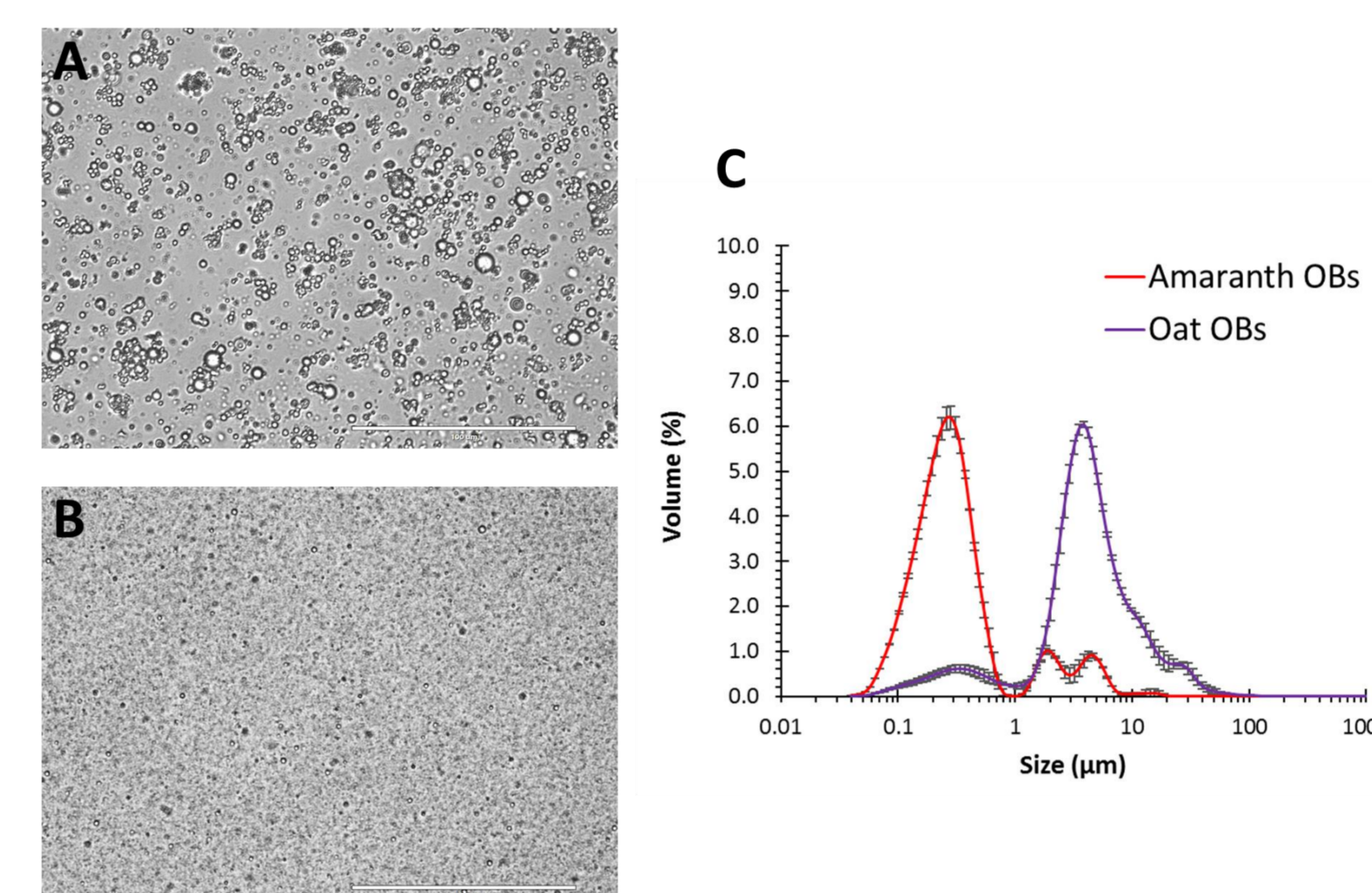


Figure 2: Light microscopy images of oat (A) and amaranth (B) OBs, and the corresponding particle size distribution.

Figure 3 indicates that great similarities in composition existed between oat and amaranth OBs (lipid bands 2923-2853 and 1745 cm^{-1} ; protein bands 1650 and 1465 cm^{-1}). The extracted oils spectra serve as references.

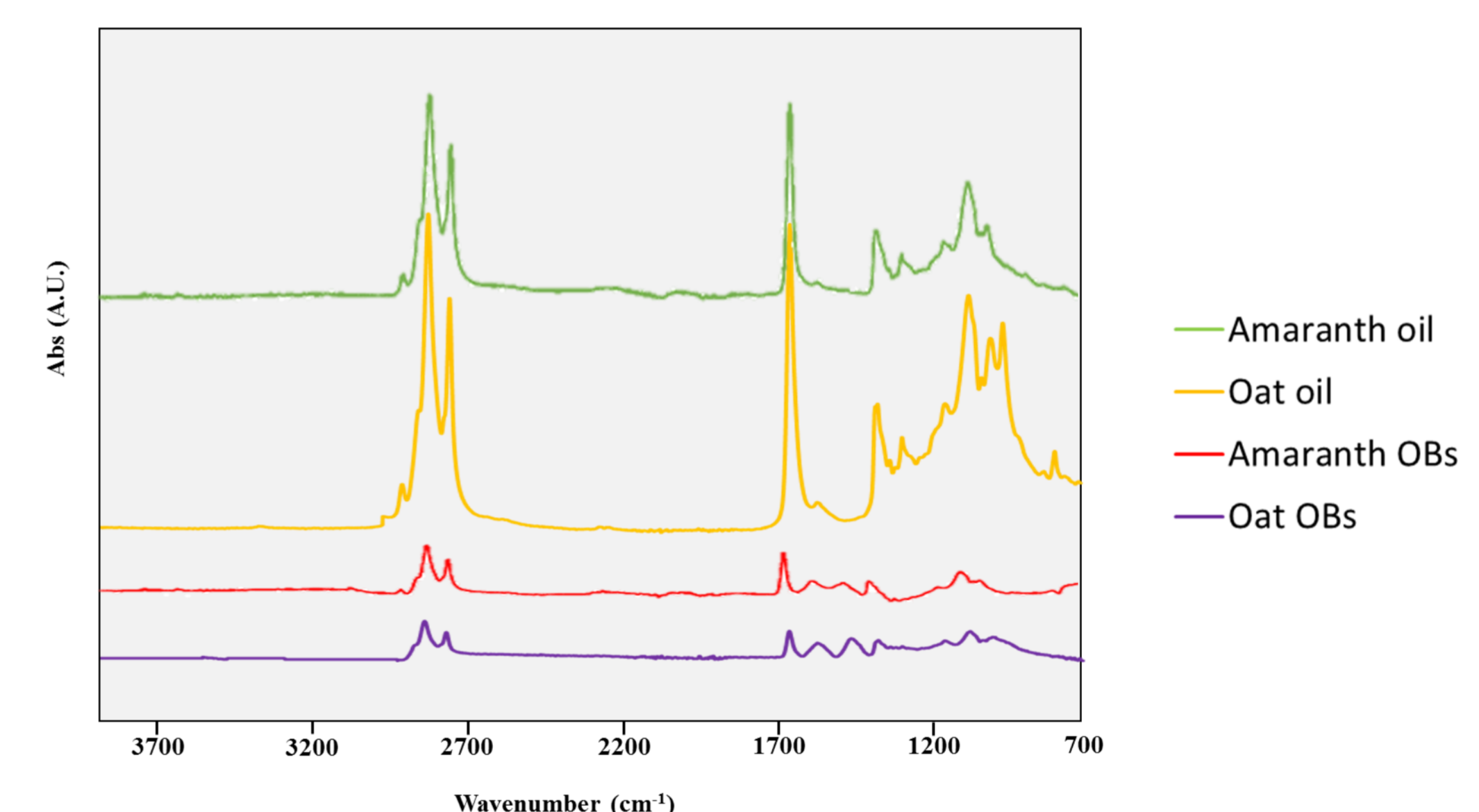


Figure 3: ATR-FTIR spectra of oat and amaranth oil and OBs.

OBs digestion

The rate and extent of lipolysis was lower for oat OBs than for amaranth OBs. These results could be explained by the small size of the amaranth OBs. Another explanation could be the presence of a network (made of proteins and β -glucan) surrounding the OBs and thereby slowing down their digestion.

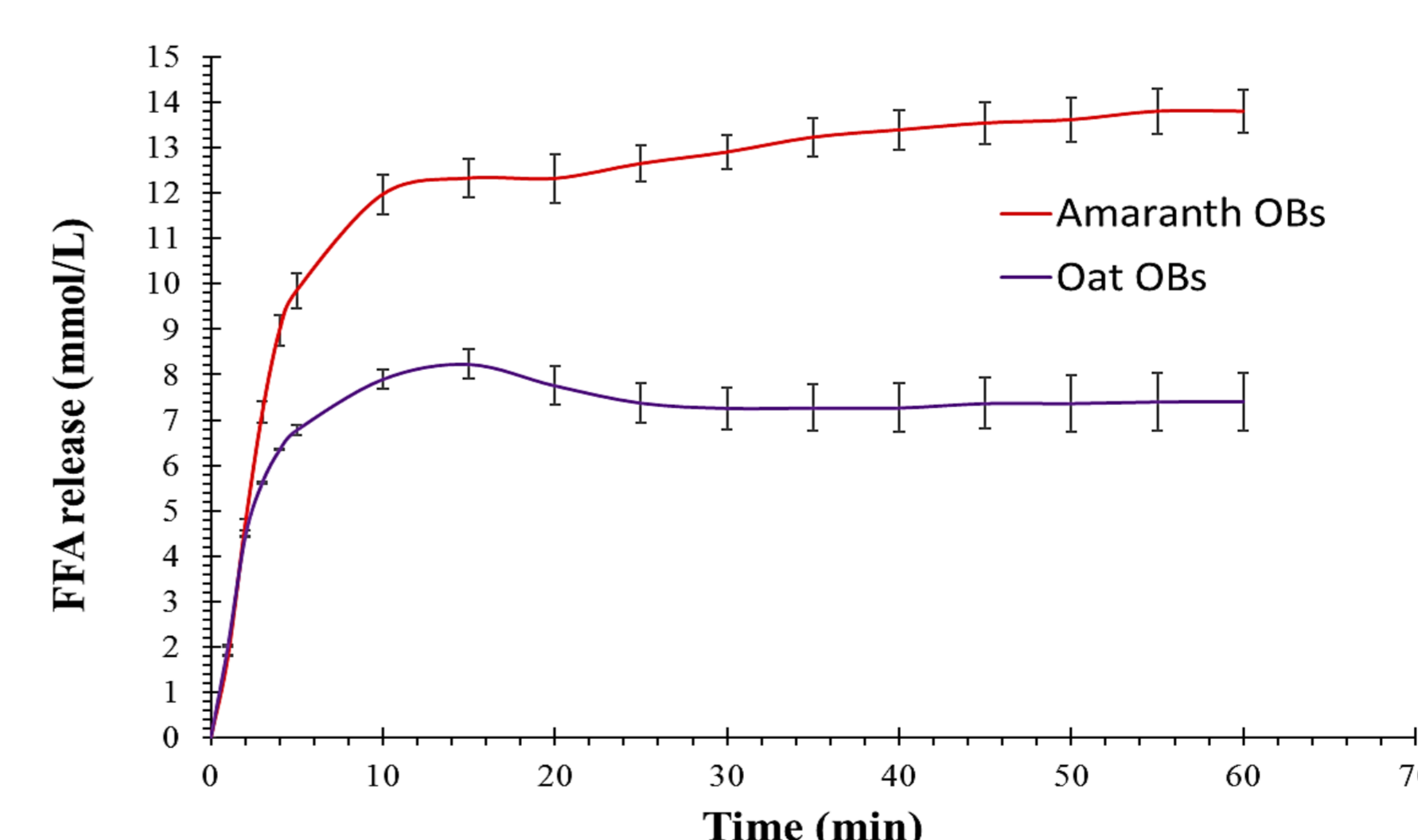


Figure 4: Free fatty acids (in mmol/L) produced during simulated duodenal digestion of the OBs.

Conclusion

The findings of this study provide further evidence of the diversity in OBs structure and composition between plant species and its impact on lipid digestion. This work could lead to the development of food products with enhanced functionality.

References

1. Huang, 'Structure of plant seed oil bodies', *Current Opinion in Structural Biology*, 4: 493-498

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