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From starch structure to its in vivo metabolic fate: advanced imagery techniques to explain the changes in starch structure during different biscuit-making processes

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Background and Objectives:

Food processes are known to alter starch structure leading to an increased digestion rate. While this assertion is true, not all of them have the same effects on starch. This study aims at **understanding the link between starch structure, digestion rate and metabolic response in different biscuit technologies.**

Methods:

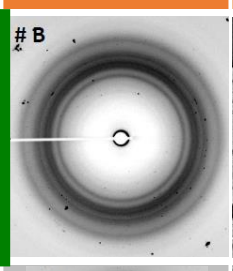
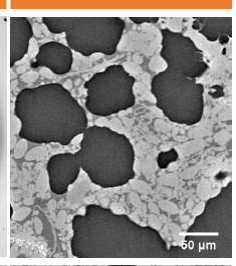
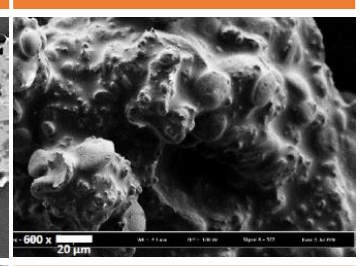
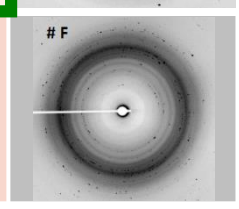
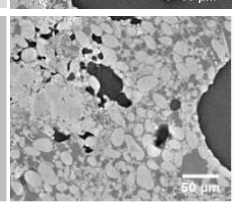
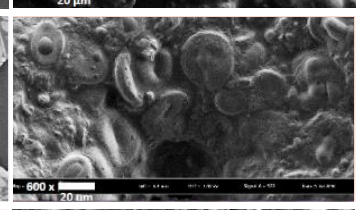
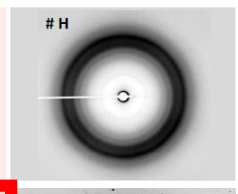
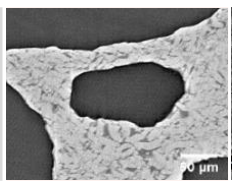
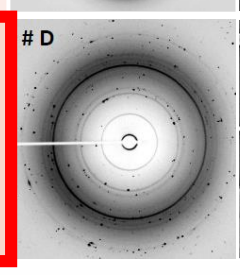
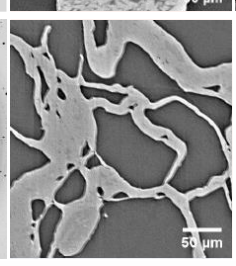
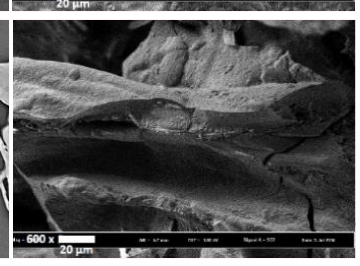
4 BISCUIT TECHNOLOGIES

- Rotary biscuit
- Soft cake
- Rusk
- Extruded cereal
  Using same ingredients, similar nutritional composition

3 METHODS OF ANALYSES

- Starch digestion kinetics:
  Slowly Digestible Starch (SDS) content
- Glycaemic Index (GI)
- Imagery techniques
  X-ray diffraction (XRD), X-ray micro-tomography and field emission gun scanning electron microscopy (FEG-SEM)

Results:

Biscuit Technology	Effect on starch structure			Imagery		
	Impact on starch	Slowly digestible starch (g/100g)	Glycaemic Index (%)	XRD	micro-tomography	FEG-SEM
Rotary biscuit	Low	24	47 ± 5			
Soft cake	Medium	2	63 ± 6			
Rusk	Medium	1	61 ± 4			
Extruded cereal	High	0.1	77 ± 4			

XRD = X-ray diffraction ; FEG-SEM = field emission gun scanning electron microscopy

The imagery technique perfectly illustrate the analytical results. High SDS and lower GI foods contain starch that has been somewhat preserved, granules are lightly altered to intact (as shown by the higher crystallinity and the presence of distinct granules). The more we degrade starch structure, up to its complete alteration, lower SDS and higher the GI values are obtained.

Conclusions:

By controlling food process, slow digestibility of starch can be maintained because of its starch structure preservation.

Keywords:

Carbohydrate metabolism, Digestion, Glycaemic index, Food process

Conflict of Interest:

All Mondelēz International employees

Further Collaborators:

Novitom Advanced 3D Micro-imaging