**Legume cells: Exploiting their digestive breakdown for healthier food solutions**

Cathrina Edwards1, Peter Ryden1, Natalia Perez-Moral1, Jennifer Ahn-Jarvis1, Balazs Bajka2, Sarah Berry2, Peter Ellis2, Mingzhu Cai3, Gary Frost3

*1Quadram Institute Bioscience, Norwich, UK. 2King’s College London, London, UK. 3Imperial College London, London, UK.*

Dietary consumption of legumes such as beans, chickpeas, lentils and peas has long been associated with beneficial effects on human cardiometabolic health. However, legumes have traditionally mainly been consumed as whole seeds, which have limited appeal to modern consumers. How can we ensure that the nutritional quality and health benefits of legumes are preserved as these crops are transformed into processed convenience foods? Understanding the mechanisms underpinning the health benefits of whole legume consumption is important to ensure that their nutritional potential is preserved into end-products.

Whole cooked legumes are comprised of intact cotyledon cells, in which the plant cell wall -a complex network of polysaccharides, encapsulates cytoplasmic nutrients such as starch and protein. Plant cell walls are resistant to mammalian enzymes of the human upper-gastrointestinal tract and can thereby regulate the digestion and absorption of intracellular nutrients from legumes[1]. As legumes are increasingly consumed as processed food products, there is a need to understand the effects of processing on cell structure and its consequences for nutrient bioaccessibility.

We have recently investigated the digestive breakdown of chickpea meals with different degrees of plant cellular intactness through the human gastrointestinal tract. Differences in meal structure were consistently found to alter nutrient bioaccessibility, impacting on the human intestinal contents with direct effects on post-prandial glycaemia and gut hormone responses[2].

Recent findings highlight the value of preserving natural legume cotyledon cell structures into processed food products to support consumer health. PulseON (PulseOn Food Ingredients Ltd) is an example of a whole cell legume flour that has been developed for such applications, and has been studied in terms of ingredient properties [3], end-product compatibility[4], through to clinical trials[5].

**References**

[1] Holland C, Ryden P, Edwards CH, Grundy MML. (2020). Plant cell walls: impact on nutrient bioaccessibility and digestibility. *Foods 9(2), 201.* <https://doi.org/10.3390/foods9020201>

[2] Frost G, Cai M, Tejpal S *et al*. (2024). Upper-Gastrointestinal Tract Metabolite Profile Regulates Glycaemic and Satiety Responses to Meals with Contrasting Structure. *PREPRINT (Version 1) available at Research Square.* <https://doi.org/10.21203/rs.3.rs-4502487/v1>

[3] Edwards CH, Ryden P, Pinto AM *et al*. (2020). Chemical, physical and glycaemic characterisation of PulseON®: a novel legume cell-powder ingredient for use in the design of functional foods. *J Functional Foods 68:103918;* <https://doi.org/10.1016/j.jff.2020.103918>

[4] Bajka BH, Pinto AM, Ahn-Jarvis J, *et al*. (2021). The impact of replacing wheat flour with cellular legume powder on starch bioaccessibility, glycaemic response and bread roll quality: A double-blind randomised controlled trial in healthy participants. *Food Hydrocolloids*, 114: 106565. <https://doi.org/10.1016/j.foodhyd.2020.106565>

[5] Bajka BH, Pinto AM, Perez-Moral N, *et al*. (2023) Enhanced secretion of satiety-promoting gut hormones in healthy humans after consumption of white bread enriched with cellular chickpea flour: A randomized crossover study. *Amer J Clin Nutr* 117: 477-489. <https://doi.org/10.1016/j.ajcnut.2022.12.008>