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Establishing methods to evaluate intestinal uptake of food proteins

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Background: What makes a food protein an allergen remains unknown. However, it has been suggested that the route of uptake in the intestine may impact on the sensitising capacity of proteins, and that the route may be influenced by protein chemical characteristics. The aim of this study was to establish methods to evaluate intestinal uptake of food proteins in order to correlate uptake to protein characteristics.
Methods: As model proteins heat-treated whey, consisting of partly denatured and aggregated proteins, was compared to native whey. The intestinal transport was investigated 1) *in vivo* in BALB/c mice i.g. dosed with the products and sacrificed after 5-45 min to determine BLG levels in serum, 2) *ex vivo* in bone marrow derived dendritic cells (BMDCs), by incubation with FITC conjugated proteins for 5-120 min before fluorescence intensity of the cells was determined by flow cytometry, and 3) *in vitro* in Caco-2 cells by determining basolateral BLG levels 1-24 hrs after adding the products apically. In addition, BLG, M cells and CDs were visualised in sections of the murine small intestine.
Results: This study indicates that the *in vivo* intestinal uptake rate differs between the two products, with the native readily being taken up and detectable 5 min after dosing. This is in line with *in vitro* results, indicating that the epithelial transport rate is faster for the native protein compared to the heat-treated. It could not be determined from intestinal sections if this was due to different uptake routes. However, *ex vivo* results indicate that DC uptake of the heat-treated proteins is greater than the native.
Conclusion: We succeeded in establishing methods that could distinguish intestinal uptake of two products with different chemical properties. These methods can be used in future studies of the interplay between uptake and sensitising capacity of food proteins to establish new ways to predict allergenicity in assessment of novel proteins.