

Effect of thermal processing on food protein digestibility and allergenicity

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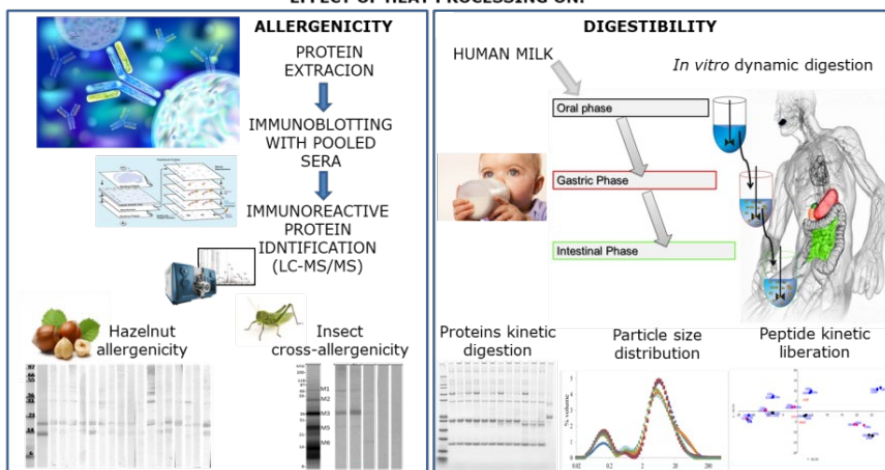
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Thermal treatment is the conventional and most commonly used processing technique for many foods in order to reduce their pathogen load, increase shelf life and improve quality and palatability. Different processing methods alter the structure of food proteins in different ways. Structural changes of food proteins induce unfolding of a protein molecule, loss of secondary and tertiary structure, formation of intra and/or inter-molecular covalent and non-covalent interactions between proteins, carbohydrates and lipids. For this reason, food processing may affect to some extent the protein fraction, also by modifying protein solubility, digestibility and allergenicity¹.

The aim of the Phd project was to investigate, by a proteomic approach, the changes in food allergenicity and digestibility induced upon processing of differently raw and processed food matrices: hazelnut, edible insects and human milk. Proteins from hazelnut and insects were extracted and the allergenic profile of raw and processed food was revealed by immunoblotting, using the sera of sensitized patients. Immune-reacting proteins were then identified by Mass Spectrometry. By studying a cohort of pediatric allergic patients in collaboration with Regina Margherita Children's Hospital (Turin), a novel allergen was discovered in hazelnut oil bodies. The sequence was submitted, accepted and assigned with the official name by the I.U.I.S. Allergen Nomenclature Subcommittee (Cor a 15). As far as edible insects are concerned, major allergens of house dust mites (HDM) and shrimp correspond to ubiquitous proteins that are widely distributed among the arthropod². In this respect, the effect of boiling and frying on the possible insects cross-allergic reaction in a cohort of HDM and shrimps allergic patients was investigated in collaboration with the Mauriziano Hospital (Turin). Processing resulted to slightly affect the cross-allergenicity potential of edible insects and it showed to be protein-, species- and treatment-specific. Human milk *in vitro* gastro-intestinal digestion was performed in order to assess whether a difference in the human milk digestive kinetics exists, depending on the type of applied pasteurization techniques (Holder vs HTST). An *in vitro* dynamic model³ was used and the digestion kinetics of proteins and peptides was studied in collaboration with the institute of Science and Technology of Milk and Eggs- INRA (Rennes, France). A better retention of native lactoferrin and milk fat globule associated proteins was found in the HTST treated milk compared to the Holder pasteurized milk. During digestion, a closer amino acid release profile was found between HTST pasteurized and raw human milk, when compared to Holder pasteurized milk, suggesting a better suitability of HTST pasteurization in preserving the original protein bio-availability of raw human milk.

The results of the Phd research allowed to discover a new hazelnut allergen and to obtain novel evidences on the effect of processing and gastro-intestinal digestion on food protein modifications and allergenicity in different foods matrices. In addition, the new evidence will be useful to highlight the biochemical basis of the immunoreaction of sensitized patients to the food allergens.

EFFECT OF HEAT PROCESSING ON:



1) Rahaman, T., Vasiljevic, T., & Ramchandran, L. (2016). Effect of processing on conformational changes of food proteins related to allergenicity. *Trends in Food Science & Technology*, 49, 24–34.

2) de Gier, S., & Verhoeckx, K. (2018). Insect (food) allergy and allergens. *Molecular Immunology*, 100, 82–106.

3) Ménard, O., Cattenoz, T., Guillemin, H., Souchon, I., Deglaire, A., Dupont, D., & Picque, D. (2014). Validation of a new *in vitro* dynamic system to simulate infant digestion. *Food Chemistry*, 145, 1039–1045.