Protein-chemical features of five different wheat products affect the sensitising capacity through the skin

Anne-Sofie R. Ballegaard[1], Cristian Piras[2], Gabriel Mazzucchelli[3], Clélia Villemin[4], Véronique Solé-Jamault[4], Sandra Denery-Papini[4], Charlotte B. Madsen[1], Katrine L. Bøgh[1]

[1]National Food Institute, Technical University of Denmark, Kgs. Lyngby, Denmark
[2]Department of Veterinary Medicine, University of Milan, Milan, Italy
[3]Laboratory of Mass Spectrometry - MolSys, Department of Chemistry, University of Liege, Liege, Belgium
[4]UR1268 BIA, INRA, Nantes, France

Background
Allergic sensitisation to foods may occur in infancy without prior oral exposure to the offending food. This has led to the assumption that food allergy sensitisation may occur through alternative routes, such as the skin. Recently, concerns have been raised regarding the safety of personal care products containing hydrolysed wheat proteins due to allergic reactions. The aim of the study was to investigate the impact of protein-chemical features on the skin sensitising capacity of five different wheat products; an unmodified, an enzyme hydrolysed, and three different acid hydrolysed gluten products.

Methods
Wheat products were characterised for size distribution profile, protein/peptide fingerprint and degree of deamidation. To study the sensitising capacity of the five wheat products a dose-response study was conducted in naïve Brown Norway rats. Products were applied on slightly damaged skin without use of adjuvant. Rats were subsequently given post-immunisations by oral gavage. The sensitising capacity and cross-reactivity were evaluated by means of different ELISAs, immunoblotting and ear swelling test.

Results
The protein-chemical features varied greatly between the products. All five products were able to induce a specific antibody response and sensitise through the slightly damaged skin, in a dose-dependent manner, though differences were seen between the products. Evaluating the cross-reactivity between the products, profound differences could be observed which correspond to the protein-chemical characteristics. Acid hydrolysed gluten products behaved differently than the enzyme hydrolysed gluten product indicating newly formed epitopes after acid hydrolysis. The protein sensitisation pattern differed between products.

Conclusion
This study showed that all five gluten products were able to sensitise through slightly damaged skin in a dose-dependent manner, though the pattern of sensitisation depended on the degree of modification.