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# Design and development of **REA**listic food **M**odels with well-characterised micro- and macro-structure and composition

## Impact of food-processing on allergenic potential of wheat and egg proteins

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Wheat and egg are ingredients that must be labeled because of their frequent involvement in food allergies. Food allergens are characterized by their ability to elicit IgE antibodies (sensitization) in susceptible individuals and to display several IgE-binding epitopes. Different structural levels: sequence, 2D/3D structures and supra-molecular organization influence this allergenic potential. It can be greatly impacted by all modifications of these structures due to heat treatment or hydrolysis. Our work aimed to analyze the impact of some types of food-technologies on the IgE-binding to wheat and egg proteins.

### Deamidation of wheat gluten

Deamidation = Chemical Modification by acidic hydrolysis



Increased solubility, new usages  
New allergy ?

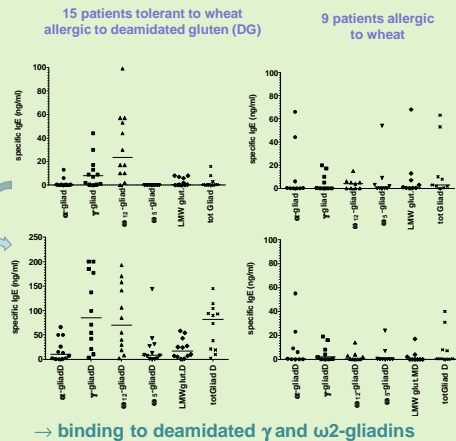


#### Comparison of IgE reactivity

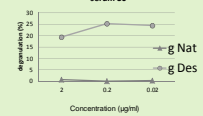
Acute Urticaria, anaphylaxis with food products as :

sausages, pork pie, meats with bread crumbs, reconstituted meats, soups or industrial cakes...

deamidation

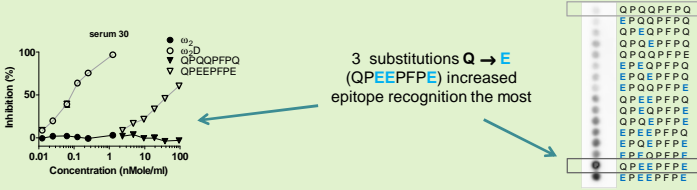


#### Validation of biological activity by RBL Activation test

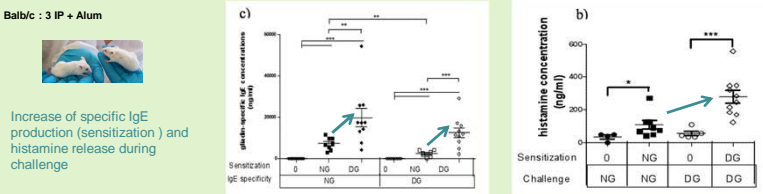


→ binding to deamidated γ and ω2-gliadins

#### Consensus epitope on γ and ω2-gliadins bound by patients allergic to DG



#### Sensitization potency in mouse model



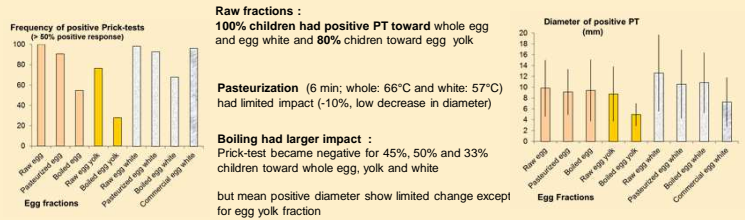
Allergy to gluten modified by acid hydrolysis is a separate entity from wheat allergy characterized by a homogeneous and strong IgE response. This modification of gliadin sequences had impacted the sensitization abilities of these proteins.

This work was financially supported by the Agence Nationale de la Recherche and carried out within the framework of Programme Alimentation et Industries Alimentaires, project ANR08-ALIA-014 PREDEXPITOPE

### Pasteurization and boiling of egg

Egg and its fractions (white and yolk) thermally treated (= physical modification) by pasteurization (industrial conditions) or boiling were tested for *in vivo* reactivity in a cohort of 49 children allergic to egg (18 months-5 years; 39 boys)

#### Cohort reactivity : frequency (%) and diameter (mm) of positive Prick-test



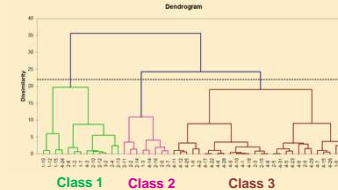
Raw fractions : 100% children had positive PT toward whole egg and egg white and 80% children toward egg yolk

Pasteurization (6 min; whole: 66°C and white: 57°C) had limited impact (-10%, low decrease in diameter)

Boiling had larger impact : Prick-test became negative for 45%, 50% and 33% children toward whole egg, yolk and white

but mean positive diameter show limited change except for egg yolk fraction

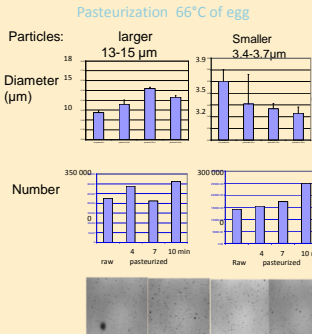
#### Analysis of relative profile of reactivity by Prick-test to egg fractions



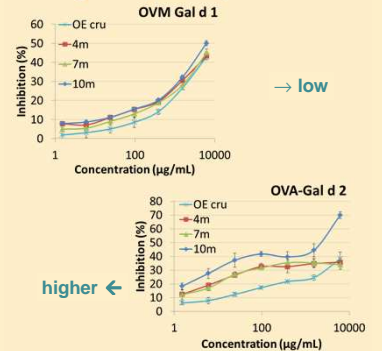
Three profiles of reactivity were evidenced by cluster analysis:

- Class 1: 13 children with decreased reactivity mostly restricted to egg yolk
- Class 2: 8 children with abolished reactivity on egg yolk upon boiling, no change on egg white and a decrease reactivity upon boiling on whole egg
- Class 3: 18 children with reduced reactivities upon both pasteurization and boiling on both egg and its fractions

#### Changes in supra-molecular structures of egg fractions upon heat treatment



#### Allergens impacted by treatment



Capacity of egg allergens to interact with IgE depends on intensity of heat treatment linked with modification of supra-molecular entities.

Whether profiles of reactivity toward differently processed egg fractions could be linked with outgrowth of allergy is currently studied.

This work was financially supported by the Agence Nationale de la Recherche and carried out within the framework of Programme National de la Recherche en Alimentation, project ANR07-PNRA-3.14 OVONUTRIAL

References \* Gourbeyre P et al. Wheat gliadins modified by deamidation are more efficient than native gliadins in inducing a th2 response in balb/c mice experimentally sensitized to wheat allergens. *Mol Nutr Food Res* 2012;56(2):336-344.  
\* Denery-Papini S et al. Allergy to deamidated gluten in patients tolerant to wheat: specific epitopes linked to deamidation. *Allergy* 2012, 67: 1023-1032

#### Consortium

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