Immunogenic and allergenic properties of egg white proteins as affected by different denaturation processes

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Aim: 70-80% of children with egg allergy can eat baked foods containing highly heated egg, showing that denaturation of egg proteins greatly modifies their allergenic potential. However, little is known about the effects of moderate denaturation treatments on the allergenicity of egg white proteins. We sought to investigate to what extent different technological processes that lead to a limited denaturation of the egg proteins can affect their immunogenic capacity. Thus, in this study, we compared the ability to sensitize and trigger allergic responses of raw egg white (R-EW), pasteurized egg white (H-EW, 80ºC-10min) and high-pressure treated egg white (P-EW, 400 mPa-10min).

Methods: BALB/c mice were orally sensitized during 7 weeks with 5 mg of either raw, heated or pressurized egg white (R-EW, P-EW or H-EW). One week after the last sensitization dose, mice were orally challenged with 50 mg of the egg white protein preparation used for sensitization and the anaphylactic responses were evaluated. During the sensitization protocol, EW-specific IgG1 and IgE were quantified weekly. Passive cutaneous anaphylaxis (PCA) tests were performed in order to know whether the immune response was IgE-mediated or both IgG1- and IgE-mediated. Cytokine production was also measured in allergen-stimulated spleen cell cultures.

Results: The highest liberation of mast cell protease, as well as the most severe anaphylactic signs and body temperature drop, were observed in P-EW sensitized and challenged mice, followed by R-EW sensitized and challenged mice. Moreover, splenocytes from mice sensitized to P-EW produced more Th2 cytokines, IL-4 and IL-5, than those from mice from the other groups in response to stimulation with the allergen. Regarding the humoral response, R-EW and P-EW promoted the highest levels of specific IgG1 at the end of the sensitization protocol, while H-EW stimulated the highest production of IgE. PCA tests confirmed that IgG1 plays an important role on the allergic reactions to R-EW and P-EW, whereas reactions to H-EW were mediated by IgE to a higher extent.

Conclusion: Denaturation of egg white proteins with high-pressure increases their sensitizing and eliciting capacity. Egg white heated to pasteurization temperatures exhibits a reduced capacity to induce anaphylactic responses despite the fact that it actively induces the production of specific IgE.