

In Japan 40 years ago, many mites contaminated stored foods, such as flour, soybean paste, soybean powder, chocolate, etc. (3). The oral administration of an antigen has been shown to induce antigen-specific peripheral immune tolerance (4, 5). It is likely that routine ingestion of the mites through ordinary meals might prevent systemic allergic reaction to the mites, since anaphylaxis in response to storage mites has not been reported before.

The sanitary conditions of stored foods have improved much in Japan, and the consumption of traditional foods such as soybean paste and soybean powder has decreased (6), leading to the lower ingestion of storage mites through ordinary meals. Since accumulated evidence demonstrated cross-antigenic and allergenic properties of the storage mite *Tyrophagus putrescentiae* and the house-dust mite *Dermatophagoides farinae* (7), lower ingestion of the storage mites might be involved in the increase in dust mite allergy. Successful treatment of mite-related asthma with oral administration of a house-dust mite extract has been reported (8, 9). Therefore, we assume that the circumstantial change in storage-mite contamination may be partly responsible for the recent increase in the prevalence of mite-related asthma.

T. MATSUMOTO, T. MIKE, T. ONO
Department of Child Development
Kumamoto University School of Medicine
1-1-1 Honjo, Kumamoto 860
Japan
Tel. 81-96-373-5197
Fax: 81-96-373-5200

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Neoallergens in heated pecan nut: products of Maillard-type degradation?

A RECENT communication in this journal describes the formation of skin-active and IgE-binding neoallergens upon storage or heating of extracts of the pecan nut (1). This interesting observation does not stand alone. A similar case was communicated in 1977, concerning an extract of wheat flour that developed increased potency upon storage at room temperature (2). A patient with baker's asthma undergoing hyposensitization treatment with aqueous solutions of the proteins of wheat flour quite unexpectedly experienced a severe anaphylactic reaction when receiving his monthly injection. The patient himself noted that the nurse was using a brown solution, whereas on previous occasions the protein extract had been colorless. Investigation revealed that the brownish treatment solution had been kept in the ward at room temperature for 7 months, contrary to instructions at the time to prepare sterile fresh solutions from the freeze-dried proteins just before use. Spectroscopic analysis of the brown liquid revealed considerable protein degradation due to autolysis involving the interaction of hydrolyzed sugars with the proteins in the extract; i.e., a so-called Maillard or "browning" reaction.

The Maillard reaction enables the chemical conjugation of free sugars to α -amino groups and to the ϵ -amino side-chains of lysine residues in the protein, leading to *de novo* haptens or to melanoidin-like complexes with proteins in a complicated series of chemical rearrangements. Such protein derivatives are known to induce non-antibody-mediated activation of the human complement system, as was demonstrated with the wheat-flour extracts in the same communication (2). Elevated skin-reactivity of heated cow's milk proteins had earlier been demonstrated by Bleumink & Berrens (3) with β -lactoglobulin, which acquired a 100-fold increase of skin test potency after mixtures of the protein with the milk sugar lactose had been maintained at 50°C. Such artificially prepared protein-sugar adducts were subsequently shown to consume

Analysis of IgE-binding material generated during processing and storage should be part of a quality-control regimen

hemolytic complement and to display increased specific IgE-binding properties (4, 5). Similar phenomena, including an increased binding of specific IgE-antibodies, are on record for soybean proteins modified by interaction with degradation products such as oxidized lipids or malondialdehyde (6).

The Maillard reaction is characterized by a very high Q_{10} -value and proceeds even at low temperatures, meaning that in most aqueous allergenic extracts stored for longer periods, such degradation reactions are almost unavoidable. Already in 1940, Strauss & Spain had observed the phenomenon in extracts of fruits and other foodstuffs and had recommended bisulfite or Na-formaldehyde-sulfoxylate as additives for preventing the Maillard reaction (7). Interestingly, protein modification in this context had been noted as early as 1912 by Kamman (8), who reported that extracts of rye pollen could acquire a 100-fold increase in (skin test) activity by autolysis during storage.

The generation of skin-active and IgE-binding material during the industrial or household handling of foods or upon storage of their aqueous extracts has implications for the standardization and control of allergenic preparations, especially those from the protein- and carbohydrate-rich foodstuffs. Clearly, the control of the shelf life of allergenic extracts should not be restricted to monitoring a decrease of potency, but must include methods of evaluating newly formed allergens as well. Therefore, we should endorse the proposal of Malanin et al. (1) to label allergenic extracts of foods with some

indication of their pretreatment, since many foodstuffs have undergone industrial manipulation or household handling before becoming available for human consumption.

PROF. DR. L. BERRENS

Research Group C.B.F. LETI
Calle del Sol, 5. Poligono industrial Norte
28760 Tres Cantos (Madrid)
Spain
Tel. ++ 34 1 803 5960
Fax: ++ 34 1 804 0919

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